PATENT ABSTRACTS OF JAPAN

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(11)Publication number : **07-211684**

(43)Date of publication of application : **11.08.1995**

(51)Int.CI. **H01L 21/304**
B08B 3/10

(21)Application number : **06-023125**

(22)Date of filing : **25.01.1994**

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(54) **METHOD AND EQUIPMENT FOR CLEANING SINGLE WAFER**

(57)Abstract:

PURPOSE: To prevent cross contamination of a proximate cleaning tank and a substrate.

CONSTITUTION: A wafer 101 received under horizontal state with the surface 101a directing upward is immersed, while inclining, into a cleaning liquid 102 generating an ascending current due to overflow. The inclining state is sustained for a predetermined time in the vicinity of the liquid surface and, at the same time, the cleaning liquid 102 is subjected to megasonic oscillation from the lateral direction of the wafer 101.

LEGAL STATUS

[Date of request for examination] 24.11.2000

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

1. CLAIMS

[Claim(s)]

[Claim 1] The single-wafer-processing substrate washing method characterized by making it hold in the state where it inclined horizontally more slightly so that the front face may come a substrate an upper surface side into the penetrant remover which is the washing method of immersing one substrate at a time into a penetrant remover, and performing washing processing, and has produced the upflow.

[Claim 2] The single-wafer-processing substrate washing method according to claim 1 of performing being immersed and drawing of the above-mentioned substrate to the above-mentioned penetrant remover in the state where it inclined horizontally more slightly so that the front face of a substrate may become an upper surface side.

[Claim 3] The single-wafer-processing substrate washing tub method according to claim 1 or 2 of discharging a megasonic wave toward the substrate immersed in the above-mentioned penetrant remover, and giving megasonic vibration to the penetrant remover around the above-mentioned substrate.

[Claim 4] The single-wafer-processing substrate washing method of any one publication of three from the claim 1 which carries out forced ventilation of the top space of the above-mentioned penetrant remover to pure air.

[Claim 5] The above-mentioned substrate is a single-wafer-processing substrate washing station characterized by being set up so that it may be in the state where it inclined horizontally more slightly, as [become / an upper surface side / the front face / in the above-mentioned immersing posture / by having the following]. The washing tub of the overflow formula which makes a penetrant remover produce a upflow while the penetrant remover immersed in a substrate is filled. A substrate immersing means to be arranged to the exterior of this washing tub, and for it to be immersed in the above-mentioned penetrant remover, and to hold a substrate. It is the posture transducer to which it comes to have the control means which carry out drive control of this substrate immersing means, and the above-mentioned substrate immersing means carries out posture conversion of the above-mentioned substrate between a carrying-in appearance posture and an immersing posture. The mechanical component which drives this posture transducer.

[Claim 6] The above-mentioned washing tub is a single-wafer-processing substrate washing station according to claim 5 made into the structure which a upflow produces in a washing tub, when the penetrant remover which it came to prepare a penetrant remover feed zone, and was supplied to the inclination lower part side of a bottom from this penetrant remover feed zone overflows from the upper-limit edge of the above-mentioned washing tub while having the inclined inner bottom among these.

[Claim 7] The posture transducer of the above-mentioned substrate immersing means is a single-wafer-processing substrate washing station according to claim 5 which comes to have the substrate receptacle held possible [removal of a substrate] and the rotation arm of the couple supported pivotably possible [rotation of the both ends of this substrate receptacle].

[Claim 8] While the arm length is mutually set up by inequality length and the end face of these rotation arm is supported pivotably by the same height position of the outside upper part of the above-mentioned washing tub with a predetermined interval, the rotation arm of the above-mentioned couple When both the above-mentioned rotation arm is in a rise rotation position, while the above-mentioned substrate is in the above-mentioned carrying-in appearance posture of a level state in the state where came to carry out pivotable support connection of the other end at the above-mentioned substrate receptacle with the predetermined interval, and the substrate was held on the

above-mentioned substrate receptacle It is set up, as it is in the above-mentioned immersing posture in the state where the above-mentioned substrate inclined horizontally more slightly, when both the above-mentioned rotation arm is in a downward rotation position. by this The single-wafer-processing substrate washing station according to claim 7 by which both the above-mentioned rotation arm faces rotating between the above-mentioned rise rotation position and a downward rotation position, and posture conversion of the posture of the above-mentioned substrate is continuously carried out between a level state and an inclination state.

[Claim 9] The single-wafer-processing substrate washing station according to claim 8 which the rotation arm of the above-mentioned couple interlocks simultaneously, and is driven.

[Claim 10] The piece of relief prevention of a substrate is prepared in the rotation arm of the above-mentioned couple, respectively. the piece of relief prevention of these couples When both the above-mentioned rotation arm is in a rise rotation position, while being separated and located from the substrate in the state where the substrate was held on the above-mentioned substrate receptacle The single-wafer-processing substrate washing station according to claim 9 constituted so that it may be approached and located in the upper surface of a substrate, when both the above-mentioned rotation arm is in a downward rotation position.

[Claim 11] The posture transducer of the above-mentioned substrate immersing means is a single-wafer-processing substrate washing station according to claim 9 or 10 in which it becomes from 4 link rotation chain mechanism of the couple arranged on both sides at the above-mentioned washing tub, and the main ** link and follower link of these 4 link rotation chain mechanism form the rotation arm of the above-mentioned couple, respectively.

[Claim 12] The single-wafer-processing substrate washing station according to claim 11 which the above-mentioned main ** link and a follower link interlock simultaneously, and is driven.

[Claim 13] The single-wafer-processing substrate washing station according to claim 11 by which the above-mentioned arm mechanical component consists of a single driving source, and 4 link rotation chain mechanism of the above-mentioned couple is coordinated with this driving source.

[Claim 14] It is the single-wafer-processing substrate washing station according to claim 5 by which comes to prepare the megasonic vibrator which generates a megasonic wave with a frequency of 0.8-1MHz in an outside [this] tub, and the megasonic wave from this megasonic vibrator is considered as the composition discharged towards the substrate immersed in the above-mentioned penetrant remover through the medium liquid in the tub outside the above while the above-mentioned washing tub is arranged in the outside tub which has medium liquid filled.

[Claim 15] The travelling direction of the above-mentioned megasonic wave is a single-wafer-processing substrate washing station according to claim 14 set up so that it may incline to the normal of the wave-receiving side of the above-mentioned washing tub.

[Claim 16] It is the single-wafer-processing substrate washing station according to claim 6 or 14 by which the interception wall is prepared in the inclination soffit of the bottom in the above, and this interception wall is installed in the position which intercepts the reflected wave of the megasonic wave from the upflow and the above-mentioned megasonic vibrator of a penetrant remover from the above-mentioned penetrant remover feed zone.

[Claim 17] A single-wafer-processing substrate washing station [equipped with the forced-ventilation means for carrying out forced ventilation of the top space of the above-mentioned washing tub] according to claim 5.

[Claim 18] The single-wafer-processing substrate washing station according to claim 5 equipped with a centering means to perform centering positioning of a substrate, in the posture transducer of the above-mentioned substrate immersing means.

[Claim 19] The driving shaft of the couple with which the above-mentioned centering means was supported to revolve horizontally and possible [rotation] on both sides of the above-mentioned posture transducer, The positioning member of the couple attached in each [these] driving shaft with the predetermined interval, The single-wafer-processing substrate washing station according to claim 18 constituted so that centering operation may be carried out, while each positioning member presses the periphery edge of a substrate, in case it comes to have the mechanical component which carries out the rotation drive of both the above-mentioned driving shafts and both the above-mentioned driving shafts rotate to a centering position.

[Translation done.]

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2. DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001] [Industrial Application] This invention relates to the technology which it immerses one sheet at a time, and washes the substrate of the shape of sheet metal, such as for example, a semiconductor wafer and a liquid crystal glass substrate, in pure water or a necessary medical fluid in a detail further about the single-wafer-processing substrate washing method and equipment.

[0002] [Description of the Prior Art] after washing of a wafer generally carries out being duration immersed of the wafer to explaining the conventional technology about the semiconductor wafer (a wafer only being called hereafter) which is an example of a substrate into medical fluids, such as a sulfuric acid, a hydrochloric acid, fluoric acid, or ammonia, it is carried out by placing necessary time into the flow of pure water

[0003] Although there are the so-called batch type which carries out two or more sheet batch processing by the number of sheets of the wafer to process, and the so-called single wafer processing which it processes one sheet at a time in that case, in the case of a batch type, there is a problem of the cross contamination between wafers, and this problem becomes larger as a wafer diameter[of macrostomia]-izes. Then, in the recent years when diameter-ization of macrostomia of a wafer is progressing, the change to single wafer processing from a batch type is tried.

[0004] The conventional single-wafer-processing washing method is drawing 17 (a). And (b) It washes by dipping necessary time, being immersed into a penetrant remover 102 and holding a wafer 101 to substrate attaching part 103a in the washing tub 103 of an overflow formula, as shown in a cross section. Under the present circumstances, dust and the particle adhering to the above-mentioned wafer 101 are removed and defecated by supplying a penetrant remover 102 through a filter 105 in the above-mentioned washing tub 103, and replacing by the penetrant remover 102 in the washing tub 103 with a pump 104.

[0005] [Problem(s) to be Solved by the Invention] However, there are the following problems also in such a conventional single-wafer-processing washing method, and the further improvement was demanded.

[00006] That is, it is drawing 17 (b) to employ efficiently the merit that the amount of the expensive penetrant remover used can be lessened in the maximum in the single-wafer-processing washing method. The washing tub 103 is thinly made as much as possible by the grade which does not have trouble in handling of a wafer 101, and, for this

reason, surface (mirror plane) 101a of a wafer 101 and rear-face 101b, and the internal surfaces 103b and 103c of the washing tub 103 are approaching mutual extremely, respectively so that it may be shown

[0007] Depending on the kind and service condition of a medical fluid, the internal surfaces 103b and 103c of the washing tub 103 will dissolve or ********** the place where the quartz glass which can be equal to the above-mentioned medical fluid use is generally used as the quality of the material of the washing tub 103 on the other hand. Consequently, a part of above-mentioned internal surfaces 103b and 103c to which it dissolved or **********ed are drawing 17 (b). It is spread in a penetrant remover 102 as particle 106 and 106 and -- so that it may be shown.

[0008] The reattachment of these particle 106 and 106 and -- will be carried out to the front rear faces 101a and 101b of the wafer 101 which original particle 107 -- was removed and defecated for the structure of the above washing tubs 103 made thinly. And these caused the short circuit during the wiring in a product, and these particle that carried out the reattachment especially the particle 106 and 106 which carried out the reattachment to surface 101a of a wafer 101, and -- had also become the cause of reducing the yield in the manufacturing process of a semiconductor device, as a result of being very hard to remove and remaining in surface 101a as it is.

[0009] Thus, **the cross contamination produced between wafers in a batch type arose in single wafer processing among the internal surfaces 103b and 103c of the washing tub 103 and the front rear faces 101a and 101b of a wafer 101 which approached,** and such a phenomenon was becoming remarkable similarly in the recent years which a wafer 101 diameter[of macrostomia]-izes in the batch type.

[0010] this invention is made in view of the trouble of this conventional technology, the place made into the purpose does not have the cross contamination under washing regardless of the size of substrate aperture, and improvement in the yield in the manufacturing process of a semiconductor device can be aimed at -- it is in offering the single-wafer-processing substrate washing method and equipment

[0011] [Means for Solving the Problem] In order to attain the above-mentioned purpose, the washing method of this invention is the washing method of immersing one substrate at a time into a penetrant remover, and performing washing processing, and it is characterized by making it hold in the state where it **inclined horizontally more slightly so that the front face may come a substrate an upper surface side into the penetrant remover which has produced the upflow.**

[0012] Being immersed and drawing of the above-mentioned substrate to the above-mentioned penetrant remover are more preferably performed in the state where it inclined horizontally more slightly so that the front face of a substrate might become an upper surface side, a megasonic wave is further discharged toward the substrate immersed in the above-mentioned penetrant remover, and megasonic vibration is given to the penetrant remover around the above-mentioned substrate.

[0013] Moreover, while the penetrant remover which the washing station of this invention is for enforcing the above-mentioned washing method, and is immersed in a substrate is filled The washing tub of the overflow formula which makes a penetrant remover produce a upflow, and a substrate immersing means to be arranged to the exterior of this washing tub, and for it to be immersed in the above-mentioned penetrant remover, and to hold a substrate, It comes to have the control means which carry out drive control of this substrate immersing means. the above-mentioned substrate immersing means It has the posture transducer which carries out posture conversion of the above-mentioned substrate between a carrying-in appearance posture and an immersing posture, and the mechanical component which drives this posture transducer, and sets into the above-mentioned immersing posture. the above-mentioned substrate It is characterized by being set up so that it may be in the state where it inclined horizontally more slightly so that the front face may become an upper surface side.

[0014] [Function] By facing it being immersed into a penetrant remover and washing a substrate, being immersed in the state where it was made to incline slightly from a horizontal, for example, near the oil level in the penetrant

remover which overflowed and has produced the upflow, and carrying out predetermined-time maintenance of this inclination state, as the front face is on an upper surface side about a substrate, the particle adhering to the front rear face of a substrate is flushed by the penetrant remover, and is washed.

[0015] It is discharged as it is out of a washing tub, without flowing to a substrate front-face [for the internal surface in this case, for example, the washing tub made from quartz glass, to be in the upflow of the penetrant remover to overflow, and defecate it especially, as for these newly generated particle] side even if a penetrant remover dissolves or **********s and particle newly occurs, and the problem of cross contamination [as / in the conventional technology] is not produced.

[0016] Moreover, removal of the particle adhering to the substrate front face is more effectively performed by discharging a megasonic wave toward the substrate immersed in the penetrant remover during washing of a substrate, and giving megasonic vibration to the penetrant remover around a substrate.

[0017] Generating of cellular **** to the rear face of the substrate which is easy to produce a substrate when immersed in the level state parallel to the oil level of a penetrant remover is prevented by performing that the substrate to the inside of a penetrant remover is immersed in the state where it inclined horizontally more slightly so that the front face of a substrate may become an upper surface side. On the other hand, the liquid piece of a substrate is promoted by performing drawing of the substrate out of a penetrant remover in the state of the same inclination.

[0018] [Example] Hereafter, the example of this invention is explained in detail based on a drawing.

[0019] Example 1 drawing 1 is the outline cross section showing the equipment configuration for enforcing the single-wafer-processing washing method concerning this invention, and the same sign is used for the member or element showing the same thing as the conventional example shown in drawing 17 in drawing 1 . One of the big differences from the conventional example is the point that **the washing tub 103 made into the overflow tub consisted of vertical sense sideways, and the wafer 101 consisted of every length every width in connection with it.**

[0020] The single-wafer-processing washing method concerning this invention is the method of carrying out washing processing of every one wafer 101, and if the surface 101a is made an upper surface side by the handling means which a wafer 101 does not illustrate and it is conveyed above the washing tub 103 in the level state by it, it will be moved to the substrate attaching part which does not illustrate this wafer 101 with this level state.

[0021] Then, by these substrate attaching part and driving means (not shown), posture conversion is carried out to the state where it inclined horizontally more slightly from the level state, and a wafer 101 is immersed and held into a penetrant remover 102 with this inclination state.

[0022] On the other hand, in the washing tub 103, the new penetrant remover 102 is supplied through a filter 105 with a pump 104 from the inclination lower part side of the inclined inner pars-basilaris-ossis-occipitalis 103c. The penetrant remover 102 removed in the foreign matter with this filter 105 overflows with the washing tub 103 upper parts while it continues being supplied into the above-mentioned washing tub 103 and produces the flow (upflow) to the upper part (it overflows).

[0023] The penetrant remover 102 overflowed from the above-mentioned washing tub 103 is returned to the circuit in which the above-mentioned pump 104 and the filter 105 were formed again, or is discharged out of a tub by the exhaust passage which is not illustrated.

[0024] A deer will be carried out, a upflow will arise in a penetrant remover 102 in the washing tub 103, and the part will push up the penetrant remover 102 between rear-face 101b of a wafer 101, and inner pars-basilaris-ossis-

occipitalis 103c of the washing tub 103 in the direction of an arrow 108. The particle 107 and 107 and -- which had originally adhered to the front rear faces 101a and 101b of a wafer 101 are flushed by the elevation flow of these penetrant removers 102, and it is discharged out of a tub with the penetrant remover 102 to overflow.

[0025] Moreover, by operation of a medical fluid etc., it dissolves or **********s and the internal surfaces 103b and 103c of the washing tub 103 made from quartz glass may be spread in a penetrant remover 102 as the particle 106 and 106 which the part newly generates, and --. without these newly generated particle 106 and 106 and -- flow by having-two-incomes operation with the upflow of a penetrant remover 102, and the inclination posture of a wafer 101 so that it may turn to the wafer surface 101a bottom important for a semiconductor device -- the radial from the circumference of a wafer 101 -- and it is smoothly discharged out of a tub with the penetrant remover 102 which goes up in layers, and the reattachment is not carried out on wafer surface 101a

[0026] After pulling up the wafer 101 which washing processing completed out of a penetrant remover 102 with an inclination state and it changes posture conversion into a level state again parallel to the oil level of a penetrant remover 102, it is delivered to the above-mentioned handling means.

[0027] Moreover, performing that the wafer 101 to a penetrant remover 102 is immersed and drawing in the state where it inclined a little [level shell] Cellular **** to wafer side 101b expected to probably be generated when a wafer 101 is first immersed in the state parallel to an oil level at the time of being immersed, It is for preventing the relief of the wafer 101 by the upflow of a penetrant remover 102, and, on the other hand, is for improving the liquid piece of a penetrant remover 102 at the time of drawing.

[0028] Moreover, an inclination state is maintained and a wafer 101 is washed for improving the rise flow of the penetrant remover 102 between wafer side 101b and inner bottom 103c of the washing tub 103.

[0029] an example 2 -- in this example, in the washing process of an example 1, when the method of giving vibration to a penetrant remover 102 is taken and it explains in detail using the same drawing 1 , it is as follows

[0030] The outside tub made from the quality of the materials, such as the fluororesin and vinylchloride resin which were excellent in 109 in drawing chemical-resistant, and stainless steel, and 110 act as medium liquid for liquids, such as pure water filled between the above-mentioned washing tub 103 which turns into an inner lift to the outside tub 109, and the outside tub 109, being shown, and transmitting the megasonic wave mentioned later to the penetrant remover 102 in the washing tub 103. 111 shows the megasonic vibrator with a frequency of 0.8-1MHz attached in side-attachment-wall 109a toward which the outside tub 109 inclined.

[0031] It discharges toward the wafer 101 immersed in the penetrant remover 102 from the longitudinal direction of the washing tub 103, and is made for the megasonic wave from this megasonic vibrator 111 to give megasonic vibration to the penetrant remover 102 around this wafer 101.

[0032] Thus, if megasonic vibration is given to a penetrant remover 102 in addition to an example 1, the particle 107 and 107 and -- adhering to the wafer 101 can remove more effectively.

[0033] The megasonic vibrator 111 was sideways attached in side-attachment-wall 109a of the outside tub 109 for making the whole equipment cheap to a thin shape again. if the megasonic vibrator 111 is incidentally attached in bottom plate 109b of the outside tub 109 as shown in drawing 2 -- equipment -- ******** -- natural, **although it becomes large-sized and the vibrator 111 corresponding to the surface integral of a wafer 101 is needed and uneconomical upwards -- it is also possible to make it such composition in consideration of other conditions etc.**

[0034] In addition, although it is almost the same as the inclination maintenance angle of a wafer 101 in the example

of illustration, the degree of setting angle of the megasonic vibrator 111 is not bought even if different.

[0035] An example 3, next one example of the single-wafer-processing washing station which embodied the washing method mentioned above are explained in detail using drawing 3 - drawing 14 .

[0036] This single-wafer-processing washing station 1 comes to have the top cover 5 of the washing tub 2, the outside tub 3, the megasonic vibrator 4, and the outside tub 3, the front lid 6 of the outside tub 3, the front lid mechanical component (front lid driving means) 7, substrate immersing equipment (substrate immersing means) 8, and a control unit (control means) 40 as the principal part.

[0037] The content of an impurity is a very few thing made from quartz glass, and the washing tub 2 has tub structure of an overflow formula, as shown in drawing 10 and drawing 11 in detail.

[0038] Namely, the side plate 202 of the polygon with which this washing tub 2 prepared two or more notches 201 and 201 and -- in the upper part, It is located in the washing section 204 and the inclination lower part of the above-mentioned bottom plate 203 which were surrounded by the inclined (it sets in the example of illustration and is about 6-degree inclination) bottom plate 203. So that the above-mentioned washing section 204, the liquid supply section (penetrant remover feed zone) 206 which was open for free passage and the liquid supply mouth 208 prepared in the level bottom plate 207 of this liquid supply section 206, the effluent mouth 209, and the above-mentioned washing section 204 may be surrounded by opening 205 The penetrant remover stripping section 212 which followed the prepared gutter section 210 for overflow liquid recovery, and the ramp 211 of this gutter section 210, the effluent mouth 214 prepared in the level bottom plate 213 of this penetrant remover stripping section 212, the above-mentioned liquid supply mouth 208, and the effluent mouth 209, It comes to have the circular legs 216 and 216 of plurality (it sets in the example of illustration and they are eight pieces) and -- which were prepared in three branch pipes 215,215,215 prepared so that it might be open for free passage to each of 214, and the row at the above-mentioned bottom plates 207 and 213.

[0039] On the above-mentioned liquid supply section 206, the inclination lower part (interception wall) 217 projects in the shape of eaves, and is prepared at the inclination soffit of a bottom plate 203. This inclination lower part 217 is arranged in the position which intercepts the upflow of the penetrant remover 9 from the above-mentioned liquid supply mouth 208, and the reflected wave of the megasonic wave from the above-mentioned megasonic vibrator 4, and is made into the structure of avoiding the bad influence to the wafer 101 by the relief of the wafer 101 at the time of supplying a penetrant remover 9, and the reflected wave in the liquid supply section 206 of a megasonic wave.

[0040] Alkali, such as an acid represented by a sulfuric acid, fluoric acid, the phosphoric acid, etc., and aqueous ammonia, a potassium hydroxide, ultrapure water, etc. are used for the penetrant remover 9 held in the washing tub 2 of the above composition.

[0041] the front wall 301 which the outside tub 3 is made from welding or molding using a fluororesin, vinylchloride resin, etc. which have resistance in the above chemicals, and consists of fixed thickness, a posterior wall of stomach 302, a left wall 303, a right wall 304, and a bottom plate 305 -- ********** -- a form [like] is presented While the opening 306 for taking a wafer 101 in and out of a level state is formed in a front wall 301, the flange 307 for attaching the megasonic vibrator 4 mentioned later projects to a posterior wall of stomach 302 back, and is prepared in it.

[0042] The bottom plate 305 of the outside tub 3 presents the shape of a stage as shown in drawing 7 and drawing 8 , and the level difference is set up equally to the level difference of the bottom plate 207 of the above-mentioned washing tub 2, and a bottom plate 213. The washing tub 2 is installed in the outside tub 3, and in two or more circular legs 216 and 216 and the state where -- was laid on the bottom plate 305 of the outside tub 3, it is constituted so that the upper part of the washing tub 2 can maintain a horizontal parallel to the oil level of a penetrant remover 9.

[0043] moreover, the position corresponding to the branch pipes 215 and 215 of the washing tub 2, and -- in the bottom plate 305 of the outside tub 3 -- three through one for branch pipes -- it has holes 308 and 308, --, the flanges 309 and 309 for branch pipes, --, the liquid supply mouth 310 of the medium liquid 10 of the megasonic wave to the outside tub 3 mentioned later and the effluent mouth 311

[0044] the above-mentioned branch pipes 215 and 215 and -- respectively -- the through ones for branch pipes -- a hole 308 is penetrated, it connects with joint 12 through the O ring seal 11, and this joint 12 is being bound tight and fixed to the above-mentioned flange 309 for branch pipes with the bolt through the seal packing 13

[0045] The tube 14 is connected to this joint 12 at well-known tube joint (a full account is not given in drawing).

[0046] As mentioned above, although the washing tub 2 is installed in the outside tub 3, since it fixes still more firmly, it is forced and fixed by the bolts 15 and 15 attached in the top cover for outside tub 3, and -- from the upper part.

[0047] The megasonic vibrator 4 emits a megasonic wave with a frequency of 0.8-1MHz, and as shown in drawing 7 , it is attached by the two seal packing 17 and 17, the pressure plate 18, and nut 19 grade which the diaphragm 401 becomes from the pressure plate 16 with a stud bolt, and an elastic body so that there may be no liquid spill in the flange 307 of the tub 3 outside the above.

[0048] From the posterior wall of stomach 302 of the tub 3 outside the above, this flange 307 inclines below slightly and is prepared, and the travelling direction of the megasonic wave from the above-mentioned megasonic vibrator 4 is set up so that it may incline to the normal of wave-receiving side 2a of the above-mentioned washing tub 2. Thereby, a diaphragm 401 can be completely sunk into medium liquid 10.

[0049] Medium liquid 10 is for passing the washing tub 2 and transmitting the megasonic wave emitted from the above-mentioned megasonic vibrator 4 to a penetrant remover 9, and is filled between the tub 3 outside the above, and the washing tub 2, and water and pure water are suitably used as this medium liquid 10.

[0050] A deer is carried out, the megasonic wave from the above-mentioned megasonic vibrator 4 is discharged towards the wafer 101 immersed in the above-mentioned penetrant remover 9 through the above-mentioned medium liquid 10, and megasonic vibration is given to the penetrant remover 9 around this wafer 101.

[0051] The top cover 5 of the outside tub 3 is attached in the outside tub 3 by two or more bolts 20 and 20 and -- as shown in drawing 8 . 21 is the concave-like air breathing lid too attached in this top cover 5 in two or more bolts 22 and 22 and --, and equips the flank by the side of the front wall 301 jutted out in the outside tub 3 with air-intake 21A for taking in pure air into the outside tub 3. Because [to which the below-mentioned tube joint 24 projects and bends from a top cover 5] way consideration was carried out, it was covered the shape of a concave with the air breathing lid 21, and thereby, it can constitute equipment thinly.

[0052] 23 is N2 of common knowledge conventionally which is a tube for oil-level detection for detecting the upper limit or minimum of the above-mentioned medium liquid 10, and is not illustrated. It connects with the sensor. It is conventionally attached in the above-mentioned air breathing lid 21 by the well-known tube joint 24, and this tube 23 for oil-level detection is always N2 in the interior. Gas is supplied. In addition, although only the tube 23 for oil-level detection for upper limit detection is illustrated by drawing 7 and drawing 8 , the object for minimum detection is similarly attached in the near side of space.

[0053] The injection nozzle 26 is being fixed to the top cover 5 with the nut 25. An injection nozzle 26 is connected to a pure water source of supply through the joint of the common knowledge which is not illustrated, and in order to rough-wash alkali, the medical fluid, i.e., the acid, left behind to the wafer 101 by which medical fluid washing was

carried out, pure water is injected from injection-tip 26A of an injection nozzle 26.

[0054] The front lid 6 is a lid for front-wall 301 of the outside tub 3, plugs up the opening 306 of a front wall 301 with the front lid mechanical component 7 which comes to attach a seal 604 in a perimeter and is mentioned later in the field which touches a front wall 301, or is opened in it by it. The opening 601 of this area is mostly formed in the field over the above-mentioned opening 306 of the front lid 6 with the cross section of opening 301.

[0055] This opening 601 is opened for free passage with well-known tube joint 27A conventionally which was connected here through the run through-hole 602 prepared in the center of the lower part of the front lid 6. 27B is the tube which the end was connected to this tube joint 27A, and was connected to the jet pipe equipped with the compulsive exhaust air function which the other end does not illustrate.

[0056] The forced-ventilation equipment (forced-ventilation means) from which the reactant gas which occurs by these before lid 6, the air breathing lid 21, tube 27B, the jet pipe, etc. when a single medical fluid or a mixed medical fluid washes a wafer 101, and Myst are removed is constituted.

[0057] That is, the wafer 101 is closed during medical fluid washing or immediately after washing, reactant gas and Myst which were generated during medical fluid washing when the suction exhaust air of the air in the outside tub 3 was compulsorily carried out by the jet pipe are exhausted together, the front lid 6 is replaced with this, pure air is inhaled from air-intake 21A of the air breathing lid 21, and the whole inside of the outside tub 3 is ventilated compulsorily. When it does in this way, reactant gas and Myst adhere to wafer 101 front face which washing ended, and there is no possibility [like] of becoming poor washing.

[0058] As shown in the front lid 6 at drawing 4 and drawing 9 , two pivots 603 using SUS (stainless steel) material etc. are fixed to right and left at a time, respectively, and it connects with the front lid mechanical component 7 which the end section mentions later.

[0059] One pair of front lid mechanical component 7 is formed in right and left, respectively, as shown in drawing 3 or drawing 6 , and drawing 9 .

[0060] One front lid mechanical component 7 mainly comes to have 4 link rotation chain mechanism 701 and a motor unit 702.

[0061] 4 link rotation chain mechanism 701 inserts in the front lid 6 equivalent to the fixed link 703, the main ** link 704, the follower link 705, and a connecting linkage, and the fixed link 703 four bearing 706 by which fitting wearing was carried out, and this bearing 706. In order to rotate the driving shaft 707 by which rate bundle fixation was carried out, and the driven shaft 708 and driving shaft 707 by which rate bundle fixation was carried out to the follower link 705 to the main ** link 704 Between two pivots 603,603 of the rocking link 710 by which rate bundle fixation was carried out through the color 709 at this driving shaft 707, the color 711 for shaft-orientations fixation of a driven shaft 708, and the lid 6 before the above, and the main ** link 704 and the follower link 705 It comes to have two bearing 712,712 with which it is equipped, and the fixed link 703 is being fixed to the lobe 312 of the outside tub 3 with the bolt.

[0062] A motor unit 702 is specifically the clevis type pneumatic cylinder 713, and the back end is supported to revolve with the pin 14 free [rocking] by the clevis dummy support 715 fixed to the lobe 313 of the outside tub 3. Moreover, the clevis metallic ornaments 717 are too attached at the nose of cam of the piston rod 716 of this pneumatic cylinder 713, and pivotable support connection of the rocking of the rocking link 710 mentioned above to these clevis metallic ornaments 717 is enabled by the pin 718.

[0063] The front lid 6 is opened and closed by the front lid mechanical components 7 and 7 of the right-and-left

couple of the above-mentioned composition. That is, if the front lid 6 is estranged from the front wall 301 of the outside tub 3, opening 306 is opened and a piston rod 716,716 projects in this and reverse as it is shown in drawing 3 and drawing 5 , when the piston rod 716,716 of a pneumatic cylinder 713,713 carries out ** ON, as shown in drawing 4 and drawing 6 , the front lid 6 will contact a front wall 301 through a seal 604.

[0064] Substrate immersing equipment 8 comes to have the transmission section 803,803 of the couple for transmitting 4 link rotation chain mechanism 801,801 of the couple as a posture transducer attached in the left wall 303 and right wall 304 of the outside tub 3, respectively, a motor unit 802, and the power of this motor unit 802 to the above-mentioned 4 link rotation chain mechanism 801,801, and the mechanical component is constituted by these motor units 802 and the transmission section 803,803.

[0065] 4 link rotation chain mechanism 801 The left wall 303 of the outside tub 3 used as a fixed link Before and after fixing to the left wall 303 or right wall 304 of a right wall 304, the 1st rotation arm 804 used as the main ** link, the 2nd rotation arm 805 used as a follower link, the substrate receptacle 806 used as a connecting linkage, and the outside tub 3, or two bearing 807,807, It is supported to revolve by the bearing 807 of a posterior free [rotation], and is supported to revolve by the end free [the rotation to the driving shaft 808 by which rate bundle fixation of the 1st rotation arm 804 was carried out, and the bearing 807 of an anterior]. In order that the 2nd rotation arm 805 may connect with the end the driven shaft 809 and the substrate receptacle 806 by which rate bundle fixation was carried out, the 1st rotation arm 804, and the substrate receptacle 806 and the 2nd rotation arm 805 respectively free [rotation], It comes to have main ******** 811 and the follower connecting shaft 812 by which rate bundle fixation of the end was carried out through the color 810,810.

[0066] The substrate receptacle 806 is drawing 12 (a). And (b) The configuration where two arms 814,814 were mostly extended from the rectangular plate 813 is presented, and two studs 815,816 from which height is different, respectively are provided in this arm 814,814 so that it may be shown. While a wafer 101 is laid on the stud 815 of the method of a low, the periphery of a wafer 101 carries out contact engagement, and is positioned by the periphery of the stud 816 of the higher one.

[0067] One round hole 817 and one long round hole 818 are formed in the plate 813 of the substrate receptacle 806 with the predetermined interval, and above-mentioned main ******** 811 and the follower connecting shaft 812 are inserted in these holes 817,818, respectively.

[0068] The 1st rotation arm 804 is drawing 13 (a). And (b) It comes to have two round holes 819,819 which insert in a driving shaft 808 and main ******** 811, the slits 820,820 for carrying out the rate bundle of this driving shaft 808 and main ******** 811 and the screw holes 821,821, and the piece 822 of relief prevention for relief prevention of the wafer 101 mentioned later so that it may be shown.

[0069] A wheel base is shorter than the 1st rotation arm 804, the 2nd rotation arm 805 is only set up, and its others are the same composition as the rotation arm 804 of the above 1st.

[0070] The end face of both the above-mentioned rotation arm 804,805 is supported pivotably by the same height position of the right-and-left wall 303,304 of the tub 3 outside the above with the predetermined interval through the above-mentioned driving shaft 808 and the driven shaft 809, respectively. On the other hand, pivotable support connection of the other end of both the rotation arm 804,805 is carried out with the predetermined interval at the plate 813 of the above-mentioned substrate receptacle 806 through above-mentioned main ******** 811 and the follower connecting shaft 812, respectively.

[0071] Thus, if constituted 4 link rotation chain mechanism 801 is used, the wafer 101 which is one feature of this invention is received from a handling means in the level state, and it is immersed in a penetrant remover in the state of an inclination, and after maintaining and washing this inclination state, the method of following a process completely contrary to the above can be attained.

[0072] This is explained in full detail using principle explanatory drawing of drawing 14 . The wheel base of the fixed link 303,304, i.e., the wheel base of the bearing 807,807 before and behind the above, b, The wheel base of c and the 2nd rotation arm 805 for the wheel base of the 1st rotation arm 804 d, Distance of the diagonal line A of e, main ******** 811, and a driven shaft 809 is set to a for the wheel base of the substrate receptacle 806. When the angle between the fixed link 303,304, the 1st rotation arm 804, and the extension wire of the fixed link 303,304 and the 2nd rotation arm 805 is set to alpha and x, respectively, the relation between these angles alpha and angle x is expressed with the following formula.

[0073]
[Equation 1]

$$\chi=\alpha+\tan^{-1}\frac{b\cdot\sin\alpha}{c-b\cdot\cos\alpha}-\cos^{-1}\frac{b^2+c^2-2bc\cdot\cos\alpha+d^2-}{2d\sqrt{b^2+c^2-2bc\cdot\cos\alpha}}$$

[0074] When both the rotation arm 804,805 is in an elevation rotation position when receiving a wafer 101 from a handling means in the mind of the oil-level upper part of a penetrant remover 9, or when delivering to a handling means that is, both the above-mentioned angle alpha and the angle x are 0 times. Thereby, the wafer 101 by which installation maintenance is carried out on the stud 815,815 of the substrate receptacle 806 is in a level state (carrying-in appearance posture) (refer to real line position of drawing 8).

[0075] The tracing 28 which angle x is larger than angle alpha, as for the angle, the wheel base d of the rotation arm 805 of ** a 2nd spreads since it is shorter than the wheel base c of the rotation arm 804 of ** a 1st although angle alpha and x will be expanded gradually, if a driving shaft 808 (and driven shaft 809) rotates, a connecting linkage 806 inclines gradually from a level state in connection with it, and a wafer 101 shows by drawing 8 is drawn.

[0076] And when both the rotation arm 804,805 is in a downward rotation position when a wafer 101 is immersed into a penetrant remover 9 that is, both the above-mentioned angle alpha and the angle x are in the maximum angle, and angle alpha is set as 90 degrees in the example of illustration. Thereby, the wafer 101 by which installation maintenance is carried out on the stud 815,815 of the substrate receptacle 806 is in the state (immersing posture) where it inclined horizontally more slightly (refer to the two-dot chain line position of drawing 8).

[0077] As mentioned above, both the above-mentioned rotation arm 804,805 will face rotating between the above-mentioned elevation rotation position and a downward rotation position, and posture conversion of the posture of the above-mentioned wafer 101 will be continuously carried out between a level state and an inclination state.

[0078] Moreover, as for the piece 822,822 of relief prevention prepared in both the above-mentioned rotation arm 804,805, the operation position is controlled according to rotation of the rotation arm 804,805. That is, in the state where the wafer 101 was held on the above-mentioned substrate receptacle 806, when both the above-mentioned rotation arm 804,805 is in the above-mentioned elevation rotation position, while the piece 822,822 of relief prevention is separated and located from the wafer 101, when both the above-mentioned rotation arm 804,805 is in the above-mentioned downward rotation position, it is approached and located in upper surface 101a of a wafer 101.

[0079] While the motor unit 802 of the wafer attaching part 8 consists of both rods type rotary pneumatic cylinder attached in the right wall 304 of the outside tub 3 and one side of the rotary rod 824 projects on the outside of the outside tub 3, another side is projected inside. A coupling rod 826 is connected with the inside lobe of the rotary rod

824 with a joint 827. The end has projected this coupling rod 826 on the outside of the outside tub 3 while it is supported to revolve free [rotation] by the bearing which is not illustrated in the housing 825 attached in the left wall 303 of the outside tub 3.

[0080] As shown in drawing 6 and drawing 15 , the transmission section 803 on the left-hand side of the wafer attaching part 8 A screw stop is carried out to the above-mentioned coupling rod 826 projected on the outside of the outside tub 3. Two ladder wheels 828,829 with an equal pitch diameter, A screw stop is carried out to a driving shaft 808 through a spacer 830. The same ladder wheel 831 of a pitch diameter as the above, The ladder wheel 833 from which a screw stop is carried out to a driven shaft 809 through a spacer 832, and the above-mentioned ladder wheel 828,829,831 and a pitch diameter differ, It comes to have the ladder chains 834 and 835 over which it was built between the above-mentioned ladder wheel 828, and 831, 829 and 833, respectively, and the power of the above-mentioned motor unit 802 is simultaneously transmitted to a driving shaft 808 and a driven shaft 809.

[0081] The right-hand side transmission section 803 is also the completely same composition as the transmission section 803 of the above-mentioned left-hand side, and is coordinated with the outside lobe of the rotary rod 824 of the above-mentioned motor unit 802.

[0082] Generally, when 4 link rotation chain mechanism 801 moves the 1st rotation arm 804, will also take the 2nd so-called rotation arm 805 simultaneously, and it will move. Although it is not necessary to drive the 2nd rotation arm 805, the backlash produced from fit tolerance etc. exists between each mechanism. when it is large The 2nd rotation arm 805 hangs down caudad, therefore a connecting linkage 806 inclines ahead, it becomes impossible to maintain a regular state and there is a possibility that a transfer and handling of a wafer 101 may be lost in a skillful pile.

[0083] Therefore, in this invention, the device is made so that the 1st rotation arm 804 and the 2nd rotation arm 805 may be driven simultaneously.

[0084] That is, in order to make it the 2nd rotation arm 805 not hang down by backlash, a driven shaft 809 is connected with a motor unit 802 by the transmission section 803, and it is constituted and is so that a back tension may always start.

[0085] Although it was easy when using the separate motor unit in order to have interlocked simultaneously and to have driven the 1st rotation arm 804 and the 2nd rotation arm 805, since it led to a cost rise, by this invention, the method of driving simultaneously the 1st rotation arm 804 and the 2nd rotation arm 805 using one motor unit 802 was used.

[0086] This is also one further feature of this invention, and is again explained in full detail using drawing 14 .

[0087] In order to drive simultaneously the 1st rotation arm 804 and the 2nd rotation arm 805 from which a wheel base differs by one motor unit 802, it is necessary to make different angle of rotation of both the rotation arm 804,805, therefore the pitch diameter of the ladder wheel 831 for driving-shaft 808 and the ladder wheel 833 for driven-shaft 809 is made different, and if it is ****, there is nothing.

[0088] The relation is expressed with the following formula when the pitch diameter of DP1 and the ladder wheel 833 for driven shafts is set to DP2 for the pitch diameter of the ladder wheel 831 for driving shafts.

[0089]
[Equation 2]

$$D_{P2} = \frac{\alpha}{\chi} \quad D_{P1}$$

[0090] If it is equal in pitch diameter DP1 of the ladder wheels 828 and 829 for motor units 802, and the ladder wheel 831 for driving shafts and pitch diameter DP2 of the ladder wheel 832 for driven shafts is made the above-mentioned relation, the 1st rotation arm 804 and the 2nd rotation arm 805 can be simultaneously driven by one above-mentioned motor unit 802.

[0091] However, a pitch diameter ratio does not restrict becoming an integral multiple, but produces an error. In order to cancel this error, the further device is made in this invention. That is, one of two holes established in the plate 813 of the connecting linkage 806 which is a wafer receptacle is made into the long round hole 818, and the above-mentioned error is absorbed.

[0092] In fact, although the single-wafer-processing washing stations constituted as mentioned above are some of all equipments used by washing down stream processing and are not illustrated, in order to raise a throughput, the handling means for conveying a wafer between several sets, a dryer, and each processor etc. is put together, and the above-mentioned single-wafer-processing washing station synchronizes, and they interlock, and are controlled by the control unit 40.

[0093] Next, processing operation which washes a wafer 101 using an above-mentioned single-wafer-processing washing station is explained.

[0094] I. Carrying in of a wafer 101 : (1) By the handling means equipped with the vacuum chuck which is not illustrated, to this side of the front lid 6 of the outside tub 3, the wafer 101 which the head end process ended is conveyed horizontally, and is standing by. In this case, a wafer 101 is in the state where the surface (mirror plane) 101a becomes the upper surface, and chucking of the inferior surface of tongue, i.e., the rear-face 101b, is carried out by the vacuum chuck of the above-mentioned handling means from the bottom.

[0095] (2) The piston rod 716,716 of the pneumatic cylinder 713,713 on either side carries out ** ON simultaneously, 4 link rotation chain mechanism 701,701 rotates, and the front lid 6 falls by this, and open the opening 306 of the outside tub 3 (refer to **drawing 3** and **drawing 5**).

[0096] (3) A handling means carries in a wafer 101 in a tub through the above-mentioned opening 306, and stands it still to the position of the substrate receptacle 806,806 on either side which stood by in the level state in the mind of the washing tub 2 upper part. In this case, a wafer 101 is positioned between the piece 822,822 of relief prevention, a stud 815,815, and a stud 816,816, as shown in **drawing 8** and **drawing 9** .

[0097] (4) The vacuum of the vacuum chuck of a handling means is changed to the atmosphere, and open rear-face 101b of a wafer 101 at the same time a handling means descends and it carries a wafer 101 on the studs 815 and 815 of four right and left, and --. Thereby, installation maintenance of the wafer 101 is carried out on the above-mentioned substrate receptacle 806,806 in the level state (carrying-in appearance posture).

[0098] (5) A handling means descends for a while further, and it is returned out of a tub at the same time it estranges what minute from a wafer 101.

[0099] (6) The piston rod 716,716 of the pneumatic cylinder 713,713 on either side projects simultaneously, 4 link

rotation chain mechanism 701,701 rotates counterclockwise, and the front lid 6 goes up, and close the opening 306 of the outside tub 3 (refer to **drawing 4** and **drawing 6**).

[0100] The II. wafer 101 is immersed. : (7) If the rotary pneumatic cylinder 802 rotates to a clockwise rotation in **drawing 8** and the 1st rotation arm 804 and the 2nd rotation arm 805 rotate clockwise, it will take to this rotation, inclination rocking of the substrate receptacle 806,806 will be carried out gradually, and a wafer 101 will be immersed in the state of an inclination in the penetrant remover 9 of the washing tub 2.

[0101] (8) If rotation of the rotary pneumatic cylinder 802 stops, in a penetrant remover 9, the wafer 101 with which the 1st rotation arm 804 and the 2nd rotation arm 805 also stopped rotation, and appeared in the substrate receptacle 806,806 will stand it still in the inclination state (immersing posture), and will be held (refer to the two-dot chain line of **drawing 8**). In this case, the pieces 822 and 822 of relief prevention and -- are approached and located in upper surface 101a of a wafer 101.

[0102] Washing of the III. wafer 101 : (9) If the pump 104 as shown in **drawing 1** is driven, from the liquid supply mouth 208 of the washing tub 2, the penetrant remover 9 which passed along the filter 105 will flow into the liquid supply section 206, will be transmitted to the bottom plate 203 which inclined from the liquid supply section 206, will go up gradually, and will be overflowed from the upper part. By this, the upflow of a penetrant remover 9 will arise in [whole] the washing tub 2.

[0103] (10) The overflowing penetrant remover is transmitted to the gutter section 210 and a ramp 211, gathers for the penetrant remover stripping section 212, and is returned to a pump 104 through branch pipe 215 joint 12 and a tube 14 from the effluent mouth 214.

[0104] (11) If the megasonic vibrator 4 is vibrated while circulating a penetrant remover 9, a megasonic wave is transmitted in medium liquid 10, will reach the penetrant remover 9 in the washing tub 2, will vibrate a penetrant remover 9, and will wash effectively surface 101a and rear-face 101b of a wafer 101.

[0105] (12) During washing, the suction exhaust air of the air in the outside tub 3 is carried out by the jet pipe, while reactant gas and Myst which were generated during medical fluid washing with this are also exhausted together, it replaces and pure air is inhaled from air-intake 21A.

[0106] Raising of the IV. wafer 101: If the rotary pneumatic cylinder 802 rotates counterclockwise and the 1st rotation arm 804 and the 2nd rotation arm 805 rotate counterclockwise after the (13) above-mentioned washing is performed fixed time, it takes to this, and the substrate receptacle 806,806 carries out inclination rocking gradually, and goes up, and a wafer 101 can pull up from a penetrant remover 9 in the state of an inclination.

[0107] (14) If rotation of the rotary pneumatic cylinder 802 stops, the 1st rotation arm 804 and the 2nd rotation arm 805 will also stop rotation, and the substrate receptacle 806,806, therefore a wafer 101 will stand it still in the level state (carrying-in appearance posture) (refer to the solid line of **drawing 8**).

[0108] V. Like the taking-out:(15) above-mentioned of a wafer 101, it has in a series of operation, the front lid 6 is lowered, and the opening 306 of the outside tub 3 is opened.

[0109] (16) Launch until it positions the vacuum chuck of a handling means in the wafer 101 bottom (rear-face side) of a level state and a vacuum chuck contacts it in a handling means at wafer side 101b.

[0110] (17) Switch a vacuum chuck to a vacuum from the atmosphere, and carry out chucking of the wafer side 101b under vacuum.

[0111] (18) Raise a handling means for a while further, and estrange a wafer 101 from the studs 815 and 815 of the substrate receptacle 806,806, and --.

[0112] (19) Drive a handling means, take out a vacuum chuck 101, i.e., a wafer, out of the outside tub 3, and convey to the following processor.

[0113] In addition, although the driving shaft 808,808 of the right-and-left couple shown in **drawing 9** may really be made from an object and a driving shaft 808, bearing 807, or a driven shaft 809 and bearing 807 are direct sliding bearing, antifriction bearing may be made to intervene in between, or you may have mechanical seal. Moreover, the opening 205 on the liquid supply section 206 of the washing tub 2 may be formed in the shape of SUNOKO.

[0114] In the washing station of example 4 practice, in order to use some kinds of medical fluids, or in order to raise a throughput, several above-mentioned single-wafer-processing washing stations are put in order, or one washing station is constituted in piles, and a wafer 101 is repeatedly moved by the handling means between each equipment.

[0115] Positive centering between each equipment (main doubling) is actually difficult, and has a possibility that a wafer 101 may shift during movement by the handling means. For this reason, the centering means for correcting a position gap between each equipment, or in between [in between / a handling means and each equipment] is needed.

[0116] As this example comes to have this centering means and specifically shows it to **drawing 15** and **drawing 16** , centering apparatus (centering means) 120 is formed in the structure of an example 3.

[0117] Two rotary pneumatic cylinders 121,121 which are the mechanical components by which this centering apparatus 120 was attached in the lobe 314,314 of the left wall 303 of the outside tub 3, The shaft 123,123 which was connected with these rotaries pneumatic cylinder 121,121 through the universal joint 122,122, and was supported to revolve by the left wall 303 and right wall 304 of the outside tub 3 free [rotation] (driving shaft), It is fixed to each of this shaft 123,123, and comes to have the pusher (positioning member) 124,124 of the right-and-left couple prepared in order to push and carry out centering of the periphery edge of a wafer 101 substantially.

[0118] A shaft 123 comes to carry out the overcoat of the Teflon resin etc. to the arbor which consists of SUS material, and with a bolt 125, a pusher 124 pushes the lock shoe 126 against a shaft 123, and is fixed.

[0119] The periphery edge is pressed down from an outside on the pushers 124 and 124 of four front and rear, right and left, the push rods 124A and 124A of --, and the periphery of --, and centering of the wafer 101 is carried out.

[0120] Next, the centering process performed using the centering apparatus 120 constituted as mentioned above is explained.

[0121] (1) From the opening 306 of the outside tub 3, a wafer 101 advances to a predetermined position by the vacuum chuck 130 of a handling means.

[0122] (2) A vacuum chuck 130 is wide opened by the atmosphere from a vacua, and it changes rear-face 101b of a wafer 101 into the state where it can estrange from a vacuum chuck 130.

[0123] (3) Clockwise, the rotary pneumatic cylinder 121 of an anterior rotates about 90 degrees of rotary pneumatic cylinders 121 of a posterior to a counterclockwise rotation, and the pushers 124 and 124 of order and -- rotate with this rotation to the perpendicular state (centering position) which shows as a solid line from the level state shown with the two-dot chain line 127,127 of **drawing 16** .

[0124] (4) Centering of the periphery edge of a wafer 101 is pushed and carried out by rotation of these pushers 124 and 124 and -- by the push rods 124A and 124A of four front and rear, right and left, and --.

[0125] (5) A vacuum chuck 130 is switched to a vacua from the atmosphere, and chucking of the rear-face 101b of a wafer 101 is carried out.

[0126] (6) The rotary pneumatic cylinder 121,121 of order rotates to a counterclockwise rotation and a clockwise rotation, respectively, and pushers 124 and 124 and -- return to a level state.

[0127] (7) A handling means moves caudad, wafer side 101b contacts the salients 815 and 815 of the substrate receptacle 806,806, and --, and a wafer 101 is carried on the substrate receptacle 806,806.

[0128] (8) The vacuum chuck 130 was wide opened by the atmosphere from the vacua, the handling means has fallen for a while further, and a vacuum chuck 130 separates from wafer side 101b.

[0129] (9) The vacuum chuck 130 of a handling means is retracted and leave the outside tub 3.

[0130] As explained in full detail above, by using this centering apparatus 120, it can become possible to correct the position gap between each equipment or between a handling means and equipment, and the reliability of moving of a wafer 101 can be raised.

[0131] In addition, the above example is for the suitable embodiment of this invention being shown to the last, and a design change is variously possible for it within the limits of this invention, without being limited to this.

[0132] [Effect of the Invention] In the state where according to this invention face it being immersed into a penetrant remover and washing a substrate, and the substrate was made to incline slightly from a horizontal as explained in full detail above as the front face was on the upper surface side In the penetrant remover which overflowed and has produced the upflow, for example, by being immersed near the oil level and carrying out predetermined-time maintenance of this inclination state Even if a penetrant remover dissolves or **********s in the internal surface of the shell which flushes the particle adhering to the front rear face of a substrate by the penetrant remover, and washed it, and a washing tub and particle newly occurs These newly generated particle is in the upflow of the penetrant remover to overflow, and it is discharged as it is out of a washing tub, without flowing to a substrate front-face [to defecate especially] side, and cross contamination is prevented effectively.

[0133] Moreover, removal of the particle adhering to the substrate front face is more effectively performed by discharging a megasonic wave toward the substrate immersed in the penetrant remover during washing of a substrate, and giving megasonic vibration to the penetrant remover around a substrate.

[0134] Generating of cellular **** to the rear face of the substrate which is easy to produce a substrate when immersed in the level state parallel to the oil level of a penetrant remover is prevented by performing that the substrate to the inside of a penetrant remover is immersed in the state where it inclined horizontally more slightly so that the front face of a substrate may become an upper surface side. On the other hand, the liquid piece of a substrate is promoted by performing drawing of the substrate out of a penetrant remover in the state of the same inclination.

[Translation done.]

1. TECHNICAL FIELD

[Industrial Application] This invention relates to the technology which it immerses one sheet at a time, and washes the substrate of the shape of sheet metal, such as for example, a semiconductor wafer and a liquid crystal glass substrate, in pure water or a necessary medical fluid in a detail further about the single-wafer-processing substrate washing method and equipment.

[Translation done.]

1. PRIOR ART

[Description of the Prior Art] after washing of a wafer generally carries out being duration immersed of the wafer to explaining the conventional technology about the semiconductor wafer (a wafer only being called hereafter) which is an example of a substrate into medical fluids, such as a sulfuric acid, a hydrochloric acid, fluoric acid, or ammonia, it is carried out by placing necessary time into the flow of pure water

[0003] Although there are the so-called batch type which carries out two or more sheet batch processing by the number of sheets of the wafer to process, and the so-called single wafer processing which it processes one sheet at a time in that case, in the case of a batch type, there is a problem of the cross contamination between wafers, and this problem becomes larger as a wafer diameter[of macrostomia]-izes. Then, in the recent years when diameter-ization of macrostomia of a wafer is progressing, the change to single wafer processing from a batch type is tried.

[0004] The conventional single-wafer-processing washing method is **drawing 17** (a). And (b) It washes by dipping necessary time, being immersed into a penetrant remover 102 and holding a wafer 101 to substrate attaching part 103a in the washing tub 103 of an overflow formula, as shown in a cross section. Under the present circumstances, dust and the particle adhering to the above-mentioned wafer 101 are removed and defecated by supplying a penetrant remover 102 through a filter 105 in the above-mentioned washing tub 103, and replacing by the penetrant remover 102 in the washing tub 103 with a pump 104.

[Translation done.]

1. EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, in this invention, it faces it being immersed into a penetrant remover and washing a substrate, is immersed for example, near the oil level in the penetrant remover which overflowed the substrate in the state where it was made to incline slightly from a horizontal as the front face was on the upper surface side, and has produced the upflow, and predetermined-time maintenance of this inclination state is carried out. Therefore, the internal surface of the shell which flushes the particle adhering to the front rear face of a substrate by the penetrant remover, and washed it, and a washing tub is discharged as it is out of a washing tub, without these newly generated particle flowing to a substrate front-face [to be in the upflow of the penetrant

remover to overflow and defecate especially] side, even if a penetrant remover dissolves or **********s and particle newly occurs, and cross contamination is prevented effectively.

[0133] Moreover, removal of the particle adhering to the substrate front face is more effectively performed by discharging a megasonic wave toward the substrate immersed in the penetrant remover during washing of a substrate, and giving megasonic vibration to the penetrant remover around a substrate.

[0134] Generating of cellular **** to the rear face of the substrate which is easy to produce a substrate when immersed in the level state parallel to the oil level of a penetrant remover is prevented by performing that the substrate to the inside of a penetrant remover is immersed in the state where it inclined horizontally more slightly so that the front face of a substrate may become an upper surface side. On the other hand, the liquid piece of a substrate is promoted by performing drawing of the substrate out of a penetrant remover in the state of the same inclination.

[Translation done.]

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1. TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, there are the following problems also in such a conventional single-wafer-processing washing method, and the further improvement was demanded.

[0006] That is, it is **drawing 17** (b) to employ efficiently the merit that the amount of the expensive penetrant remover used can be lessened in the maximum in the single-wafer-processing washing method. The washing tub 103 is thinly made as much as possible by the grade which does not have trouble in handling of a wafer 101, and, for this reason, surface (mirror plane) 101a of a wafer 101 and rear-face 101b, and the internal surfaces 103b and 103c of the washing tub 103 are approaching mutual extremely, respectively so that it may be shown
[0007] Depending on the kind and service condition of a medical fluid, the internal surfaces 103b and 103c of the washing tub 103 will dissolve or ********** the place where the quartz glass which can be equal to the above-mentioned medical fluid use is generally used as the quality of the material of the washing tub 103 on the other hand. Consequently, a part of above-mentioned internal surfaces 103b and 103c to which it dissolved or **********ed are **drawing 17** (b). It is spread in a penetrant remover 102 as particle 106 and 106 and -- so that it may be shown.

[0008] The reattachment of these particle 106 and 106 and -- will be carried out to the front rear faces 101a and 101b of the wafer 101 which original particle 107 -- was removed and defecated for the structure of the above washing tubs 103 made thinly. And these caused the short circuit during the wiring in a product, and these particle that carried out the reattachment especially the particle 106 and 106 which carried out the reattachment to surface 101a of a wafer 101, and -- had also become the cause of reducing the yield in the manufacturing process of a semiconductor device, as a result of being very hard to remove and remaining in surface 101a as it is.

[0009] Thus, the cross contamination produced between wafers in a batch type arose in single wafer processing among the internal surfaces 103b and 103c of the washing tub 103 and the front rear faces 101a and 101b of a wafer 101 which approached, and such a phenomenon was becoming remarkable similarly in the recent years which a wafer 101 diameter[of macrostomia]-izes in the batch type.

[0010] this invention is made in view of the trouble of this conventional technology, the place made into the purpose does not have the cross contamination under washing regardless of the size of substrate aperture, and improvement in the yield in the manufacturing process of a semiconductor device can be aimed at -- it is in offering the single-wafer-

processing substrate washing method and equipment

[Translation done.]

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1. OPERATION

[Function] By facing it being immersed into a penetrant remover and washing a substrate, being immersed in the state where it was made to incline slightly from a horizontal, for example, near the oil level in the penetrant remover which overflowed and has produced the upflow, and carrying out predetermined-time maintenance of this inclination state, as the front face is on an upper surface side about a substrate, the particle adhering to the front rear face of a substrate is flushed by the penetrant remover, and is washed.

[0015] It is discharged as it is out of a washing tub, without flowing to a substrate front-face [for the internal surface in this case, for example, the washing tub made from quartz glass, to be in the upflow of the penetrant remover to overflow, and defecate it especially, as for these newly generated particle] side even if a penetrant remover dissolves or **********s and particle newly occurs, and the problem of cross contamination [as / in the conventional technology] is not produced.

[0016] Moreover, removal of the particle adhering to the substrate front face is more effectively performed by discharging a megasonic wave toward the substrate immersed in the penetrant remover during washing of a substrate, and giving megasonic vibration to the penetrant remover around a substrate.

[0017] Generating of cellular **** to the rear face of the substrate which is easy to produce a substrate when immersed in the level state parallel to the oil level of a penetrant remover is prevented by performing that the substrate to the inside of a penetrant remover is immersed in the state where it inclined horizontally more slightly so that the front face of a substrate may become an upper surface side. On the other hand, the liquid piece of a substrate is promoted by performing drawing of the substrate out of a penetrant remover in the state of the same inclination.

[Translation done.]

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1. EXAMPLE

[Example] Hereafter, the example of this invention is explained in detail based on a drawing.

[0019] Example 1 **drawing 1** is the outline cross section showing the equipment configuration for enforcing the single-wafer-processing washing method concerning this invention, and the same sign is used for the member or element showing the same thing as the conventional example shown in **drawing 17** in **drawing 1** . One of the big differences from the conventional example is the point that the washing tub 103 made into the overflow tub consisted of vertical sense sideways, and the wafer 101 consisted of every length every width in connection with it.

[0020] The single-wafer-processing washing method concerning this invention is the method of carrying out washing processing of every one wafer 101, and if the surface 101a is made an upper surface side by the handling means which a wafer 101 does not illustrate and it is conveyed above the washing tub 103 in the level state by it, it will be moved to the substrate attaching part which does not illustrate this wafer 101 with this level state.

[0021] Then, by these substrate attaching part and driving means (not shown), posture conversion is carried out to the state where it inclined horizontally more slightly from the level state, and a wafer 101 is immersed and held into a penetrant remover 102 with this inclination state.

[0022] On the other hand, in the washing tub 103, the new penetrant remover 102 is supplied through a filter 105 with a pump 104 from the inclination lower part side of the inclined inner pars-basilaris-ossis-occipitalis 103c. The penetrant remover 102 removed in the foreign matter with this filter 105 overflows with the washing tub 103 upper parts while it continues being supplied into the above-mentioned washing tub 103 and produces the flow (upflow) to the upper part (it overflows).

[0023] The penetrant remover 102 overflowed from the above-mentioned washing tub 103 is returned to the circuit in which the above-mentioned pump 104 and the filter 105 were formed again, or is discharged out of a tub by the exhaust passage which is not illustrated.

[0024] A deer will be carried out, a upflow will arise in a penetrant remover 102 in the washing tub 103, and the part will push up the penetrant remover 102 between rear-face 101b of a wafer 101, and inner pars-basilaris-ossis-occipitalis 103c of the washing tub 103 in the direction of an arrow 108. The particle 107 and 107 and -- which had originally adhered to the front rear faces 101a and 101b of a wafer 101 are flushed by the elevation flow of these penetrant removers 102, and it is discharged out of a tub with the penetrant remover 102 to overflow.

[0025] Moreover, by operation of a medical fluid etc., it dissolves or **********s and the internal surfaces 103b and 103c of the washing tub 103 made from quartz glass may be spread in a penetrant remover 102 as the particle 106 and 106 which the part newly generates, and --. without these newly generated particle 106 and 106 and -- flow by having-two-incomes operation with the upflow of a penetrant remover 102, and the inclination posture of a wafer 101 so that it may turn to the wafer surface 101a bottom important for a semiconductor device -- the radial from the circumference of a wafer 101 -- and it is smoothly discharged out of a tub with the penetrant remover 102 which goes up in layers, and the reattachment is not carried out on wafer surface 101a

[0026] After pulling up the wafer 101 which washing processing completed out of a penetrant remover 102 with an inclination state and it changes posture conversion into a level state again parallel to the oil level of a penetrant remover 102, it is delivered to the above-mentioned handling means.

[0027] Moreover, performing that the wafer 101 to a penetrant remover 102 is immersed and drawing in the state where it inclined a little [level shell] Cellular **** to wafer side 101b expected to probably be generated when a wafer 101 is first immersed in the state parallel to an oil level at the time of being immersed, It is for preventing the relief of the wafer 101 by the upflow of a penetrant remover 102, and, on the other hand, is for improving the liquid piece of a penetrant remover 102 at the time of drawing.

[0028] Moreover, an inclination state is maintained and a wafer 101 is washed for improving the elevation flow of the penetrant remover 102 between wafer side 101b and inner pars-basilaris-ossis-occipitalis 103c of the washing tub 103.

[0029] an example 2 -- in this example, in the washing process of an example 1, when the method of giving vibration to a penetrant remover 102 is taken and it explains in detail using the same **drawing 1** , it is as follows

[0030] The outside tub made from the quality of the materials, such as the fluororesin and vinylchloride resin which were excellent in 109 in drawing chemical-resistant, and stainless steel, and 110 act as medium liquid for liquids, such as pure water filled between the above-mentioned washing tub 103 which turns into an inner lift to the outside tub 109, and the outside tub 109, being shown, and transmitting the megasonic wave mentioned later to the penetrant remover 102 in the washing tub 103. 111 shows the megasonic vibrator with a frequency of 0.8-1MHz attached in side-attachment-wall 109a toward which the outside tub 109 inclined.

[0031] It discharges toward the wafer 101 immersed in the penetrant remover 102 from the longitudinal direction of the washing tub 103, and is made for the megasonic wave from this megasonic vibrator 111 to give megasonic vibration to the penetrant remover 102 around this wafer 101.

[0032] Thus, if megasonic vibration is given to a penetrant remover 102 in addition to an example 1, the particle 107 and 107 and -- adhering to the wafer 101 can remove more effectively.

[0033] The megasonic vibrator 111 was sideways attached in side-attachment-wall 109a of the outside tub 109 for making the whole equipment cheap to a thin shape again. if the megasonic vibrator 111 is incidentally attached in bottom plate 109b of the outside tub 109 as shown in **drawing 2** -- equipment -- ******** -- natural, although it becomes large-sized and the vibrator 111 corresponding to the surface integral of a wafer 101 is needed and uneconomical upwards -- it is also possible to make it such composition in consideration of other conditions etc.

[0034] In addition, although it is almost the same as the inclination maintenance angle of a wafer 101 in the example of illustration, the degree of setting angle of the megasonic vibrator 111 is not bought even if different.

[0035] An example 3, next one example of the single-wafer-processing washing station which embodied the washing method mentioned above are explained in detail using **drawing 3** - **drawing 14** .

[0036] This single-wafer-processing washing station 1 is the top cover 5 of the washing tub 2, the outside tub 3, the megasonic vibrator 4, and the outside tub 3, the front lid 6 of the outside tub 3, and a front lid mechanical component.

[Translation done.]

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1. DESCRIPTION OF DRAWINGS

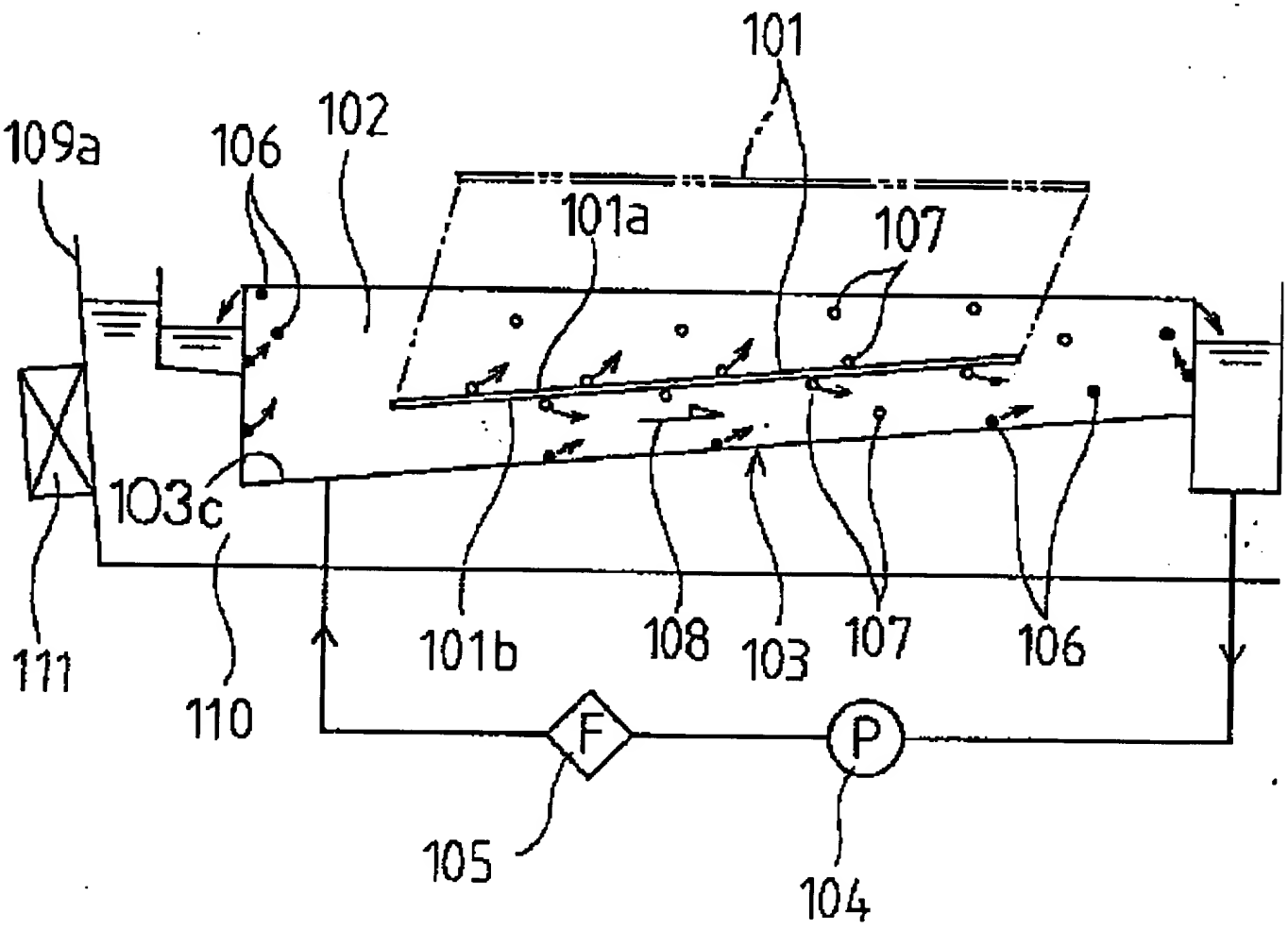
[Brief Description of the Drawings]
[Drawing 1] It is the outline cross section showing the equipment configuration which enforces the single-wafer-processing washing method concerning the example 1 and example 2 of this invention.
[Drawing 2] It is the outline cross section showing the composition of the example of equipment comparison for explaining the usefulness of the single-wafer-processing washing method of this example 2.
[Drawing 3] It is the front view showing the single-wafer-processing washing station which is the example 3 of this invention after the front lid has opened.
[Drawing 4] It is the front view showing this single-wafer-processing washing station after the front lid has closed.
[Drawing 5] It is a left lateral view in **drawing 3** of this single-wafer-processing washing station.
[Drawing 6] It is a left lateral view in **drawing 4** of this single-wafer-processing washing station.
[Drawing 7] It is the cross section which met the A-A line of **drawing 4** of this single-wafer-processing washing station.
[Drawing 8] It is the cross section expanding and showing a part of **drawing 7** of this single-wafer-processing

washing station.
[Drawing 9] It is the plan expanding and showing a part of this single-wafer-processing washing station.
[Drawing 10] It is the plan showing the washing tub of this single-wafer-processing washing station.
[Drawing 11] It is the left lateral view of this washing tub.
[Drawing 12] The substrate receptacle of this single-wafer-processing washing station is shown, and it is **drawing 12** (a). A plan and **drawing 12** (b) It is front view.
[Drawing 13] The rotation arm of this single-wafer-processing washing station is shown, and it is **drawing 13** (a). A plan and **drawing 12** (b) It is front view.
[Drawing 14] It is principle explanatory drawing of 4 link rotation chain mechanism of this single-wafer-processing washing station.
[Drawing 15] It is the plan showing a part of single-wafer-processing washing station which is the example 4 of this invention.
[Drawing 16] It is the cross section showing a part of this single-wafer-processing washing station along with the C-D-E-F line of **drawing 15** .
[Drawing 17] The conventional single-wafer-processing washing station is shown, and it is **drawing 17** (a). Outline cross-section explanatory drawing and **drawing 17** (b) **Drawing 17** (a) It is the expanded sectional view which met the B-B line.
[Description of Notations]
1 Single-Wafer-Processing Washing Station
2 Washing Tub
3 Outside Tub
4 Megasonic Vibrator
8 Substrate Immersing Equipment (Substrate Immersing Means)
9 Penetrant Remover
10 Medium Liquid
40 Control Unit (Control Means)
101 Wafer
101a The front face of a wafer (mirror plane)
101b The rear face of a wafer
102 Penetrant Remover
103 Washing Tub (Overflow Tub)
104 Pump
105 Filter
106,107 Particle
109 Outside Tub
110 Medium Liquid
111 Megasonic Vibrator
120 Centering Apparatus (Centering Means)
121 Rotary Pneumatic Cylinder (Mechanical Component)
123 Shaft (Driving Shaft)
124 Pusher (Positioning Member)
203 Bottom Plate (Inner Pars Basilaris Ossis Occipitalis)
204 Washing Section
206 Liquid Supply Section (Penetrant Remover Feed Zone)
217 Inclination Lower Part (Interception Wall)
801 4 Link Rotation Chain Mechanism (Posture Transducer)
802 Rotary Pneumatic Cylinder (Motor Unit)
803 Transmission Section
804 1st Rotation Arm
805 2nd Rotation Arm
806 Substrate Receptacle
822 Piece of Relief Prevention

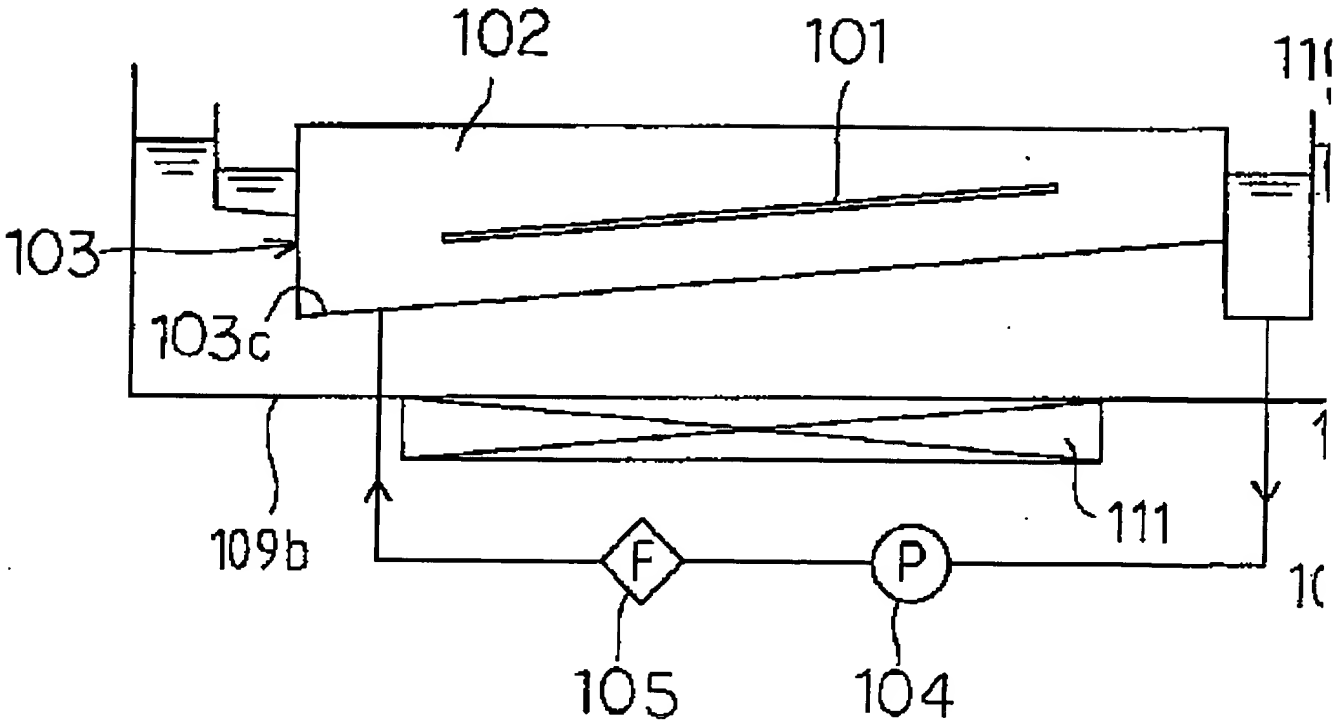
[Translation done.]

1. DRAWINGS

[Drawing 1]

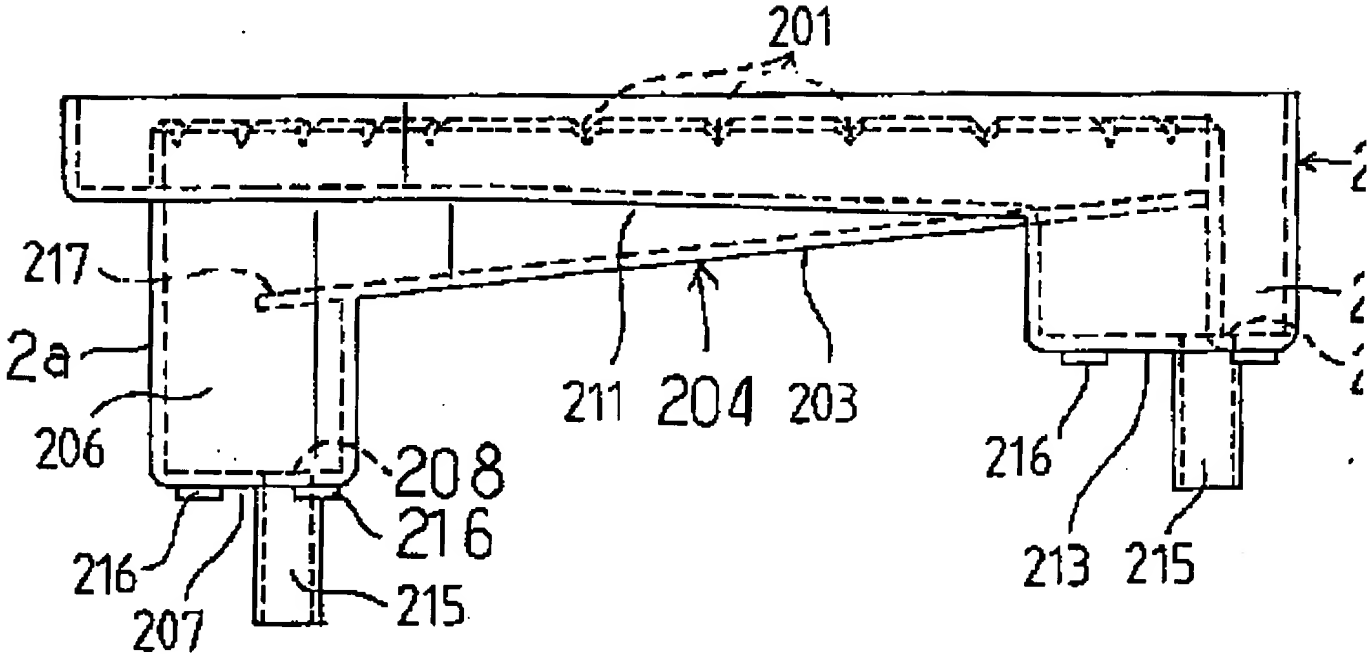


[Drawing 2]



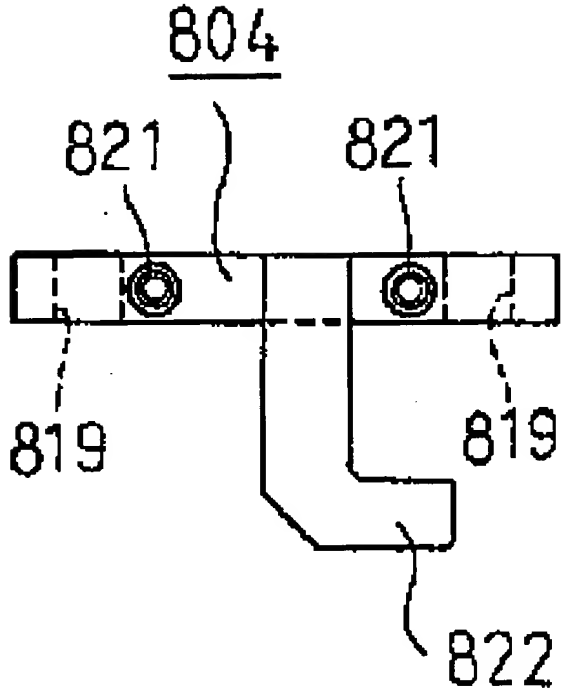
[Drawing 11]

2



[Drawing 13]

(a)



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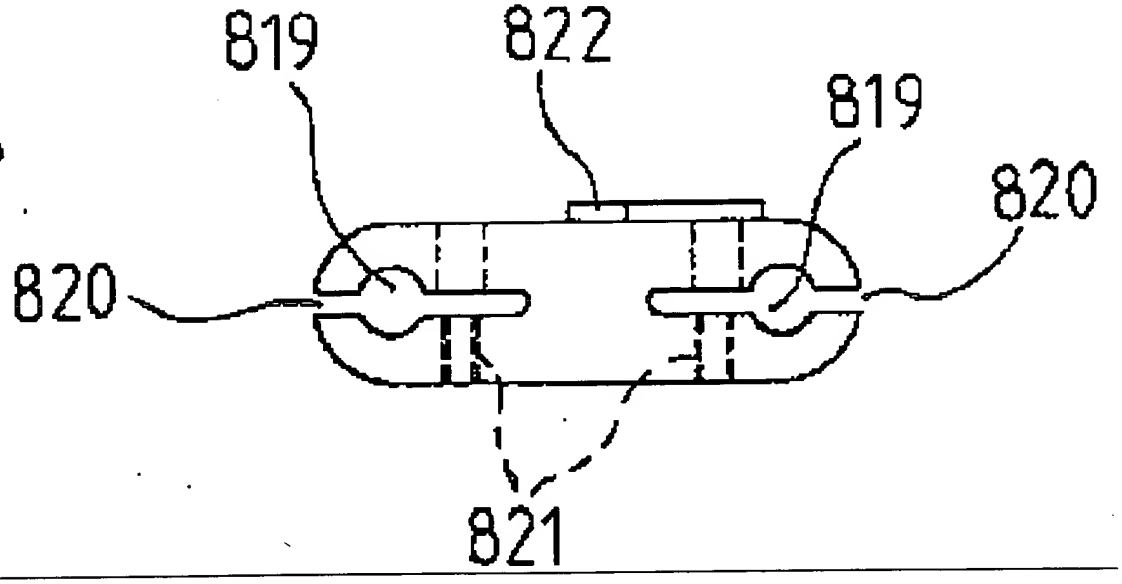
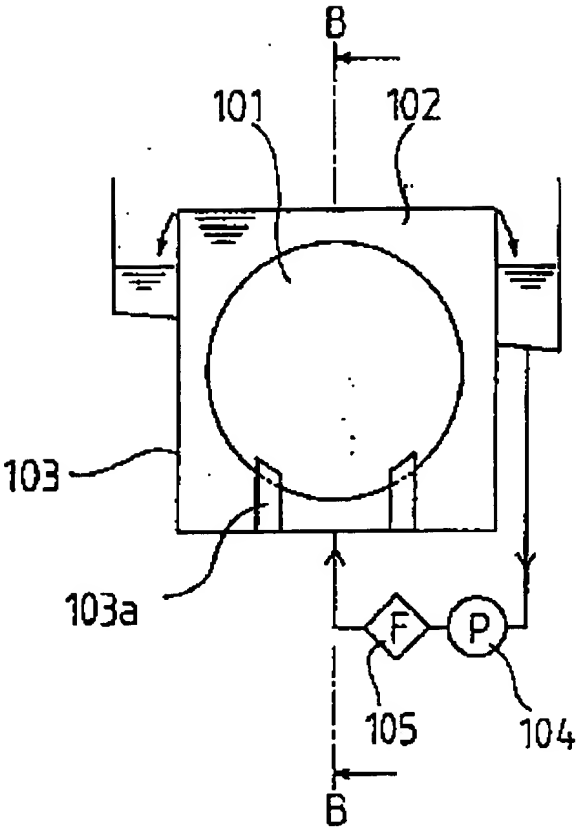
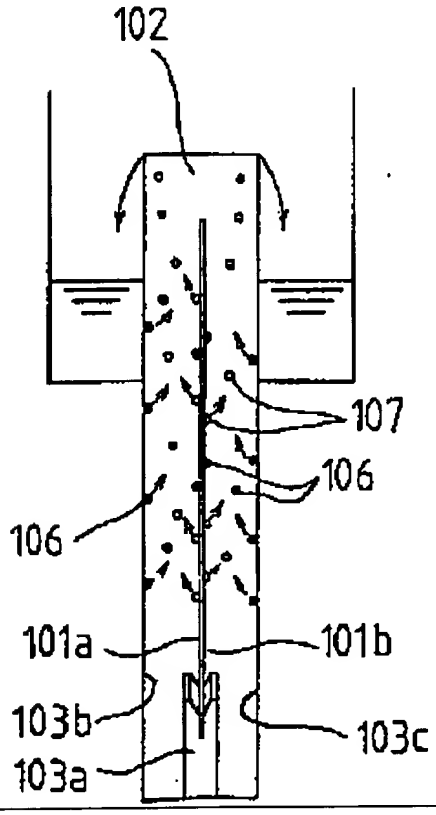


[Drawing 17]

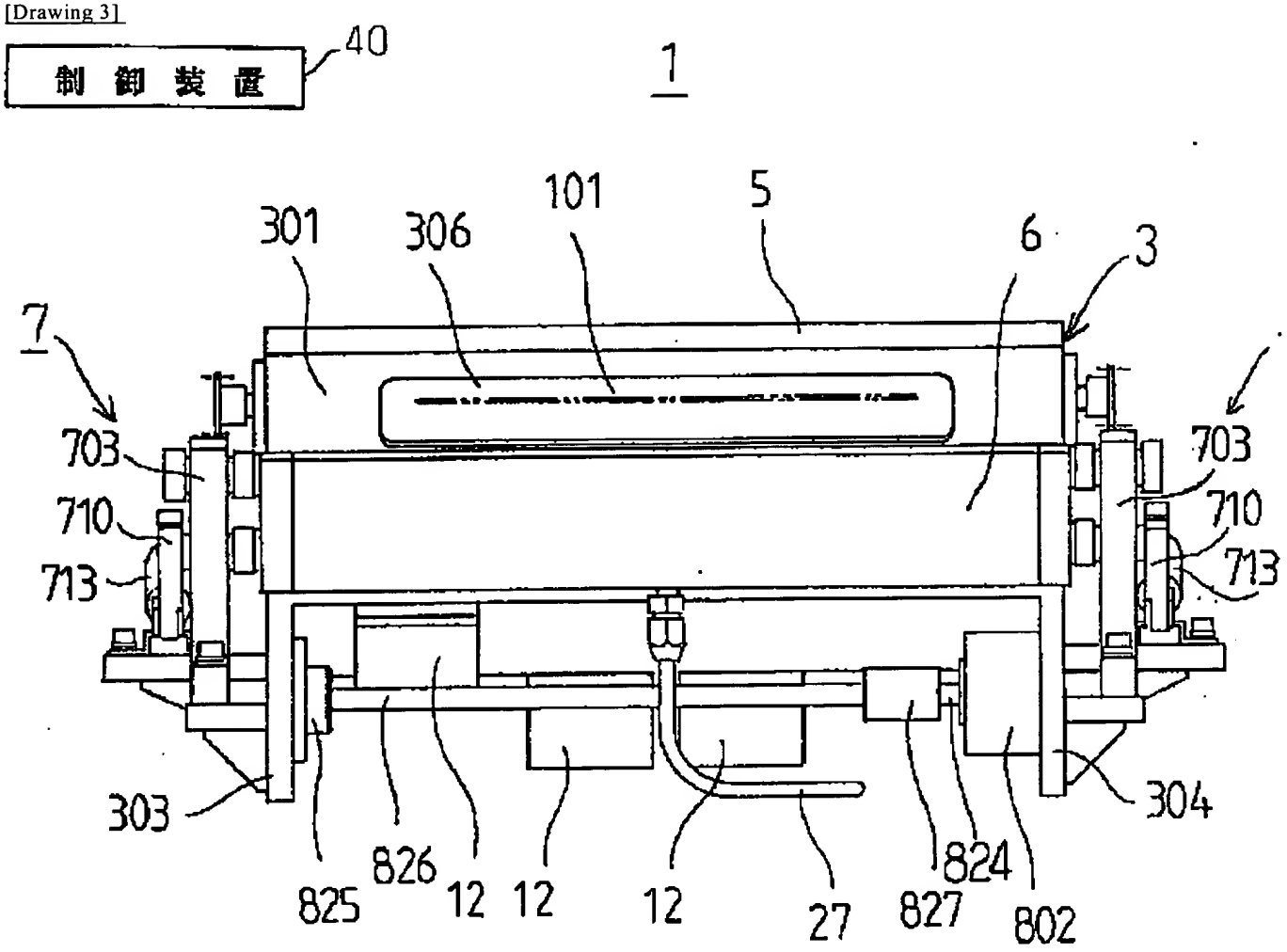
(a)


B
101
102
103
103a
F
P
105
104
B

(b)


102
107
106
106
101a
101b
103b
103c
103a

[Drawing 3]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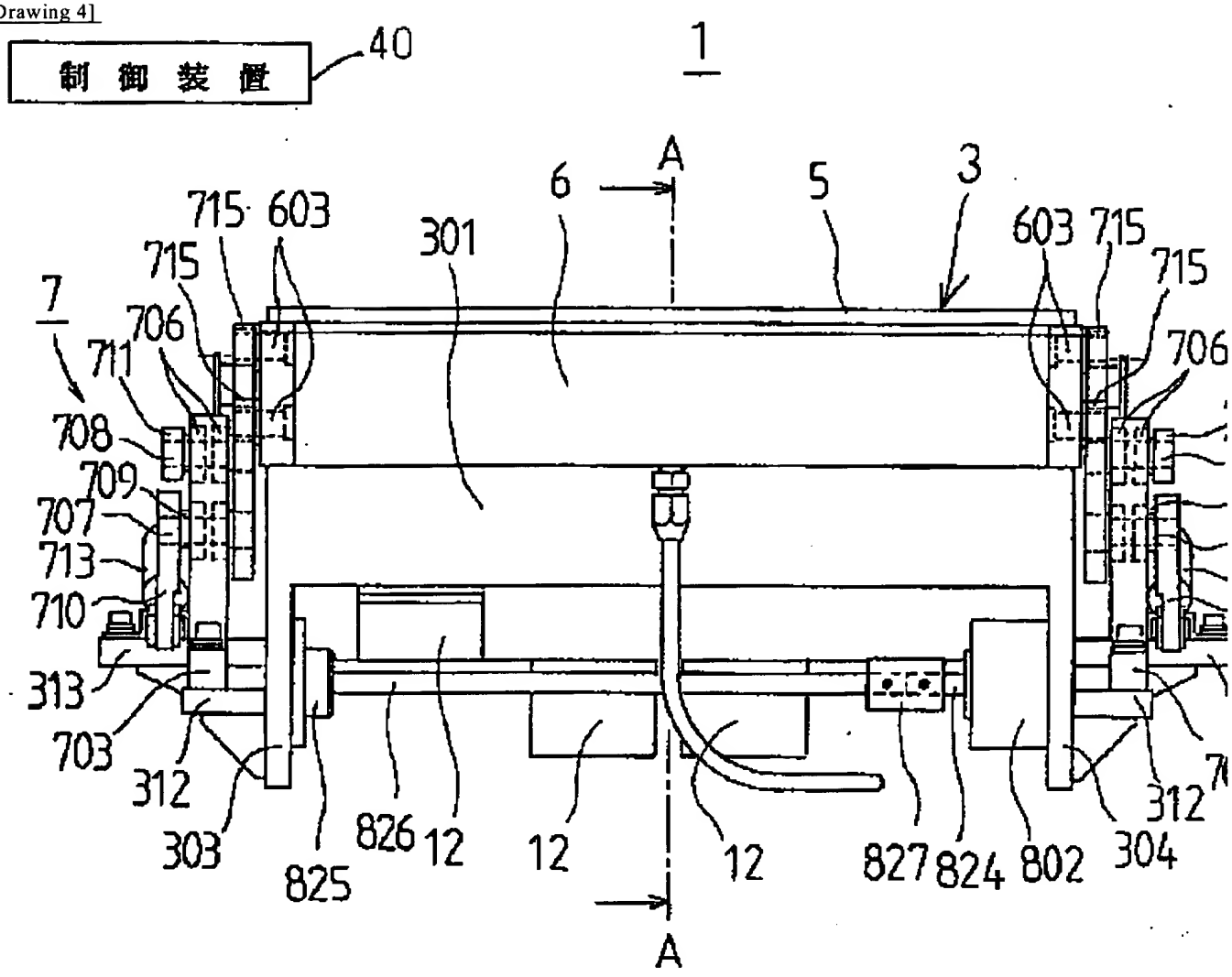
827
824
802

[Drawing 4]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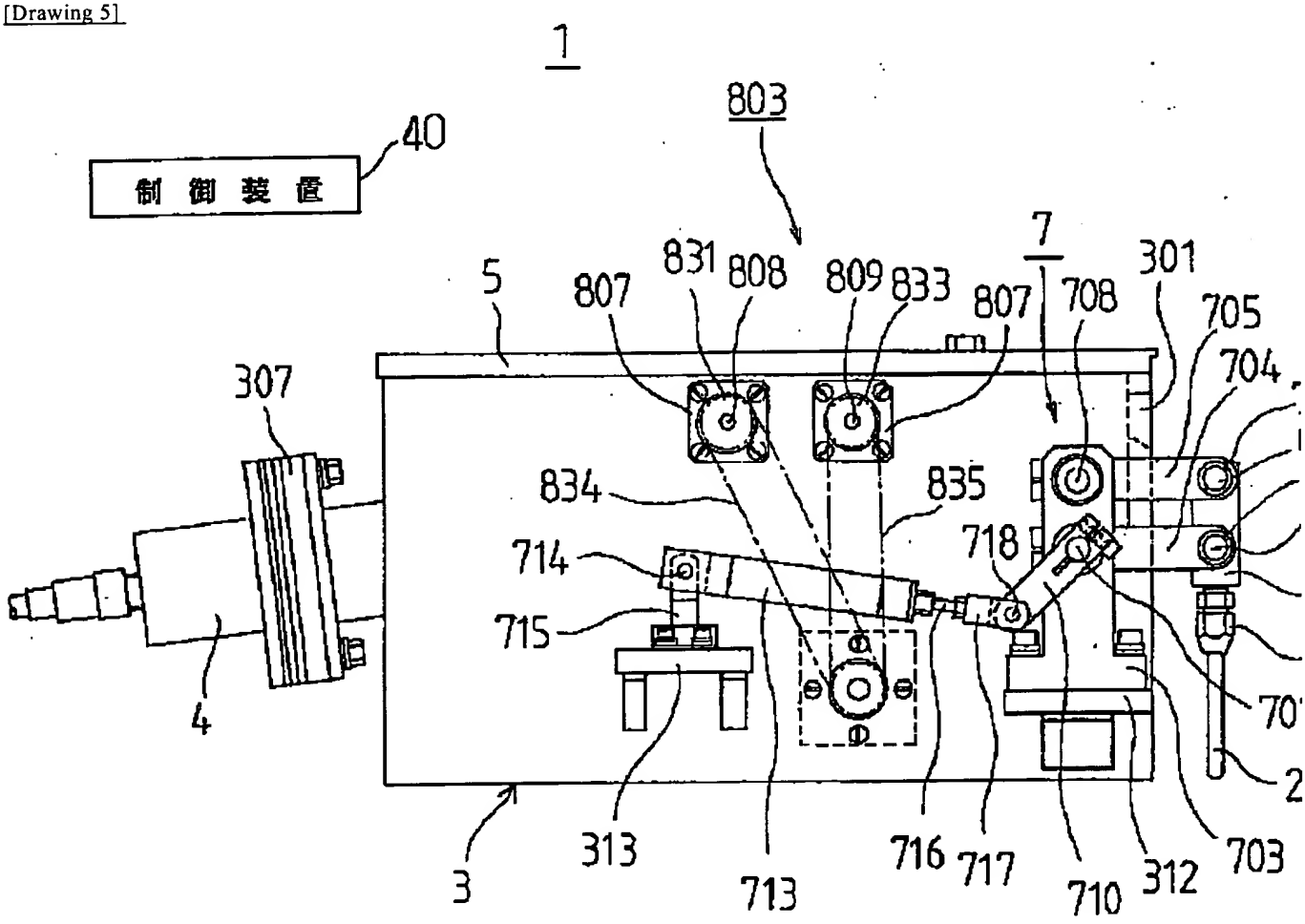
824
802
304
312
A

[Drawing 5]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708
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715
4
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713
716
717
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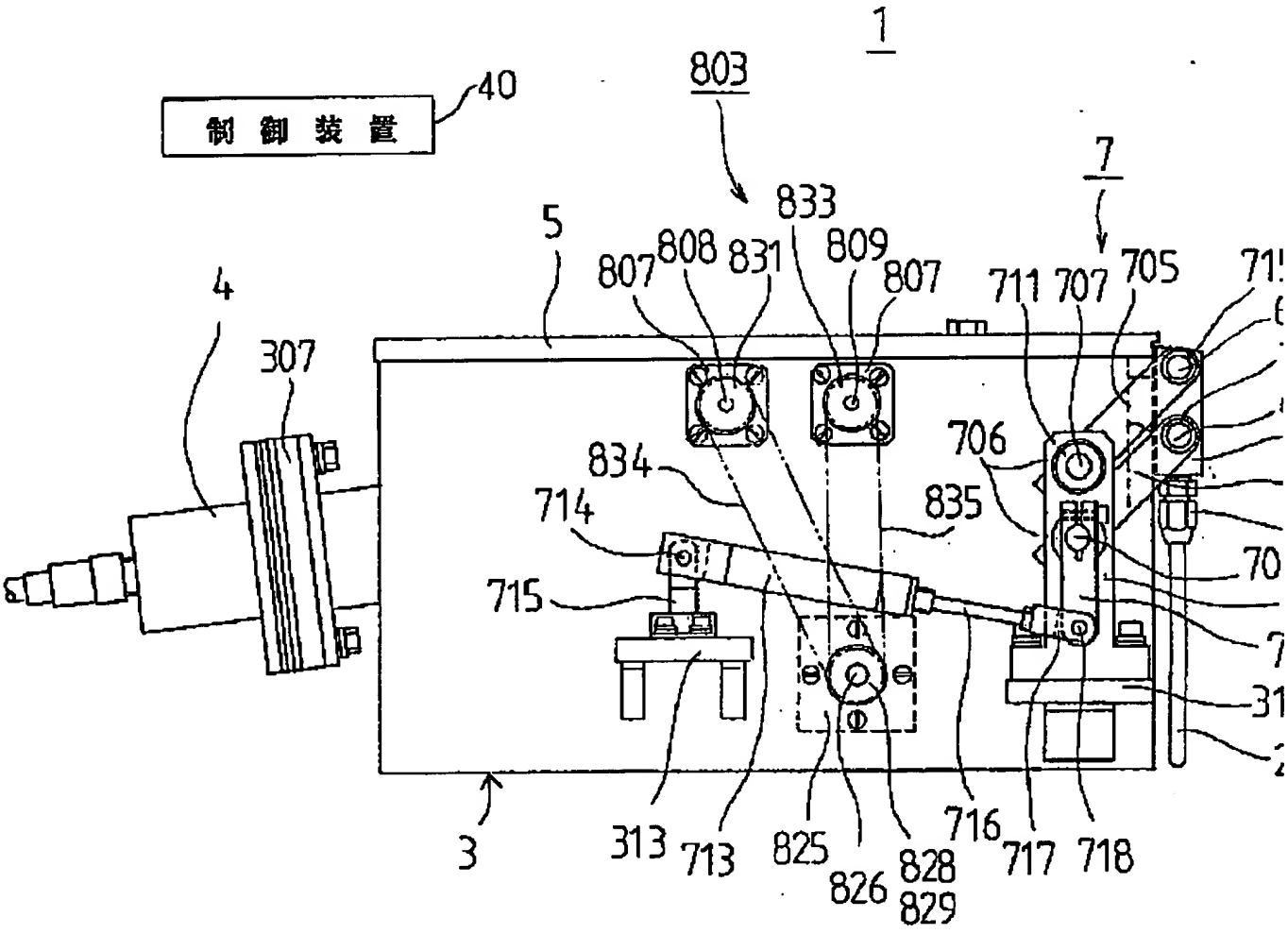
312
703
3
2

[Drawing 6]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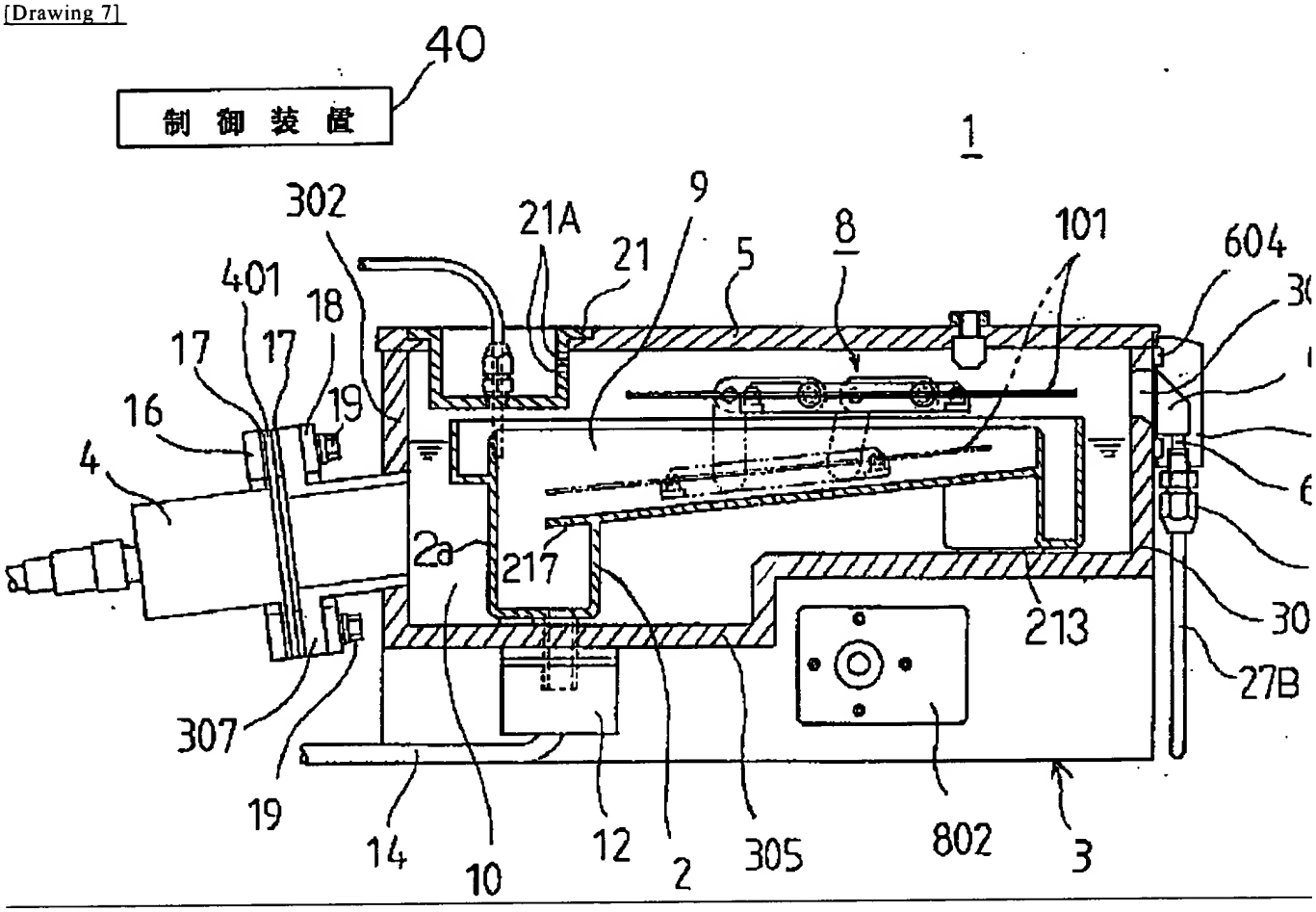
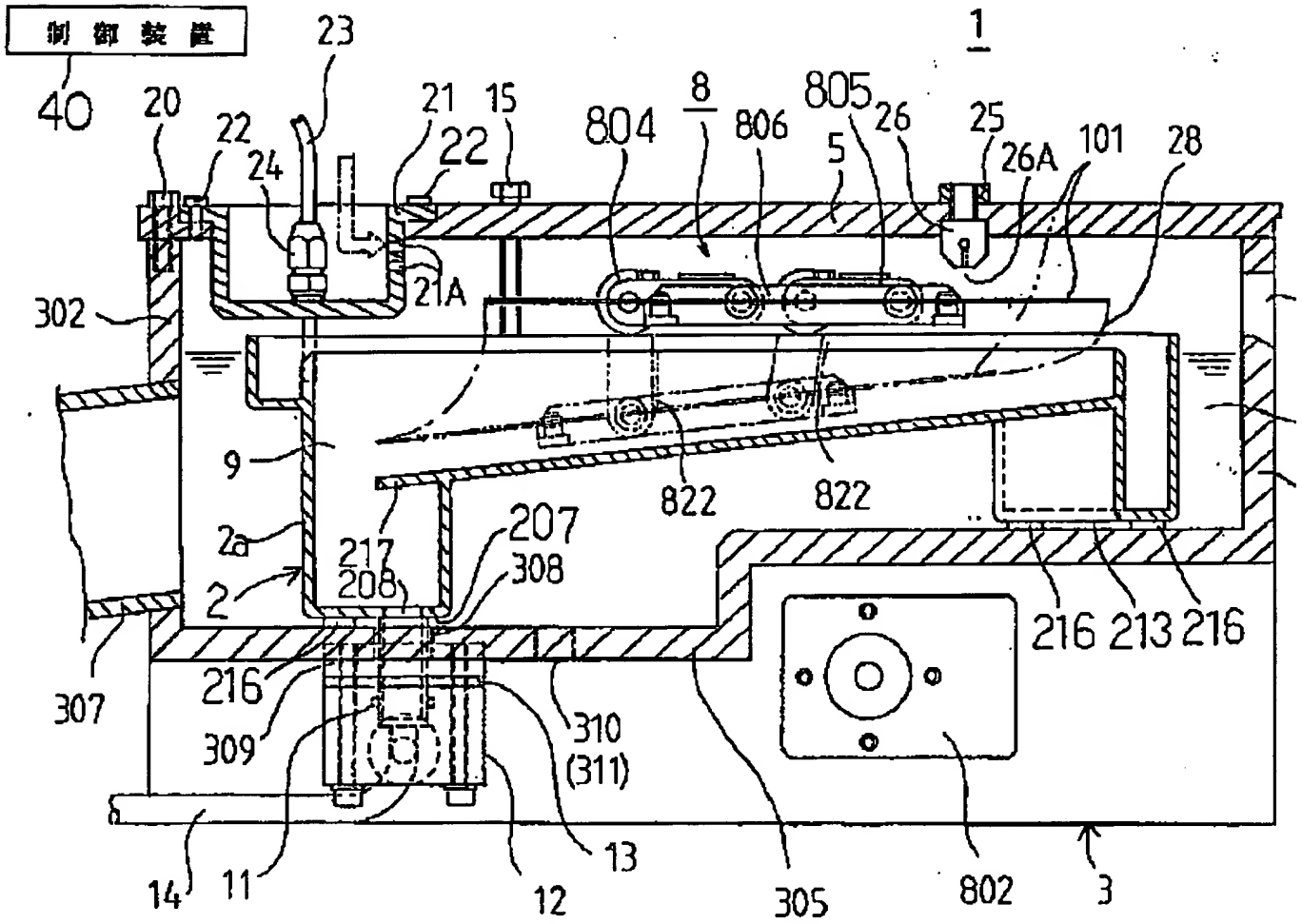
[Drawing 7]



[Drawing 8]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822
822
207
2a
217
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(311)
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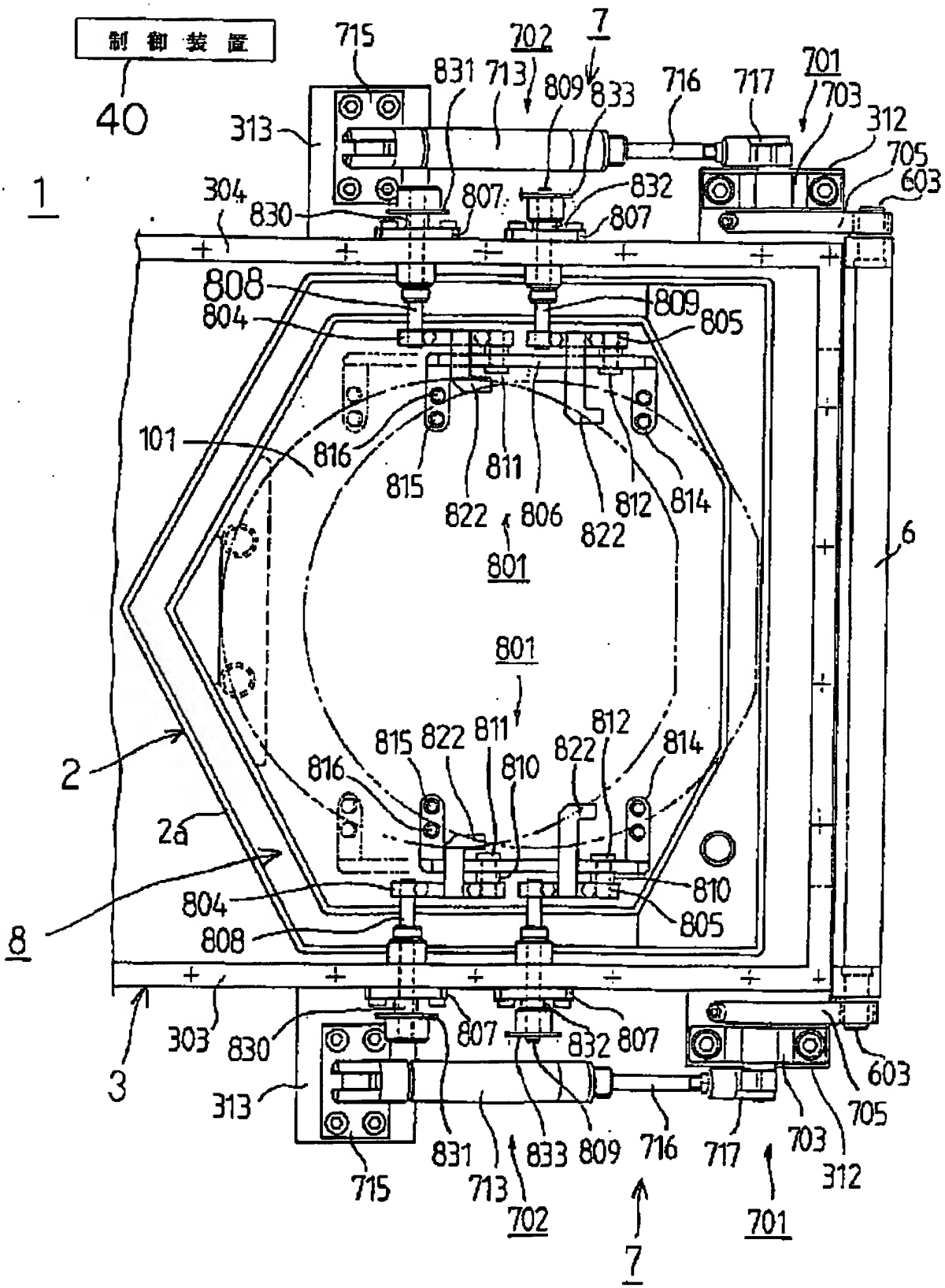
802
3

[Drawing 9]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804
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810
303
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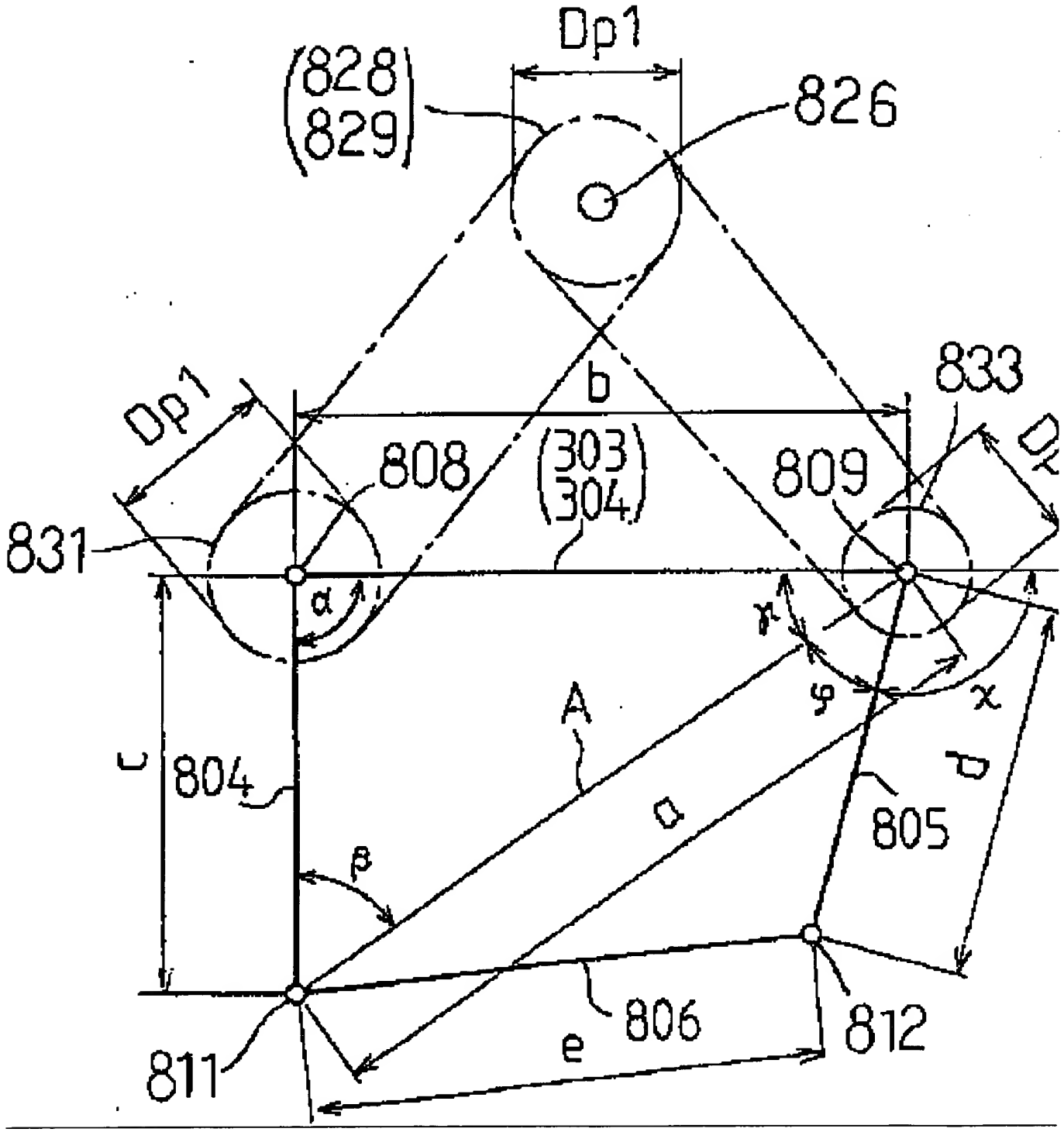
[Drawing 14]


Dp1
(828)
(829)
826
Dp1
b
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(303)
(304)
809
831
α
γ
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χ
A
U
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a
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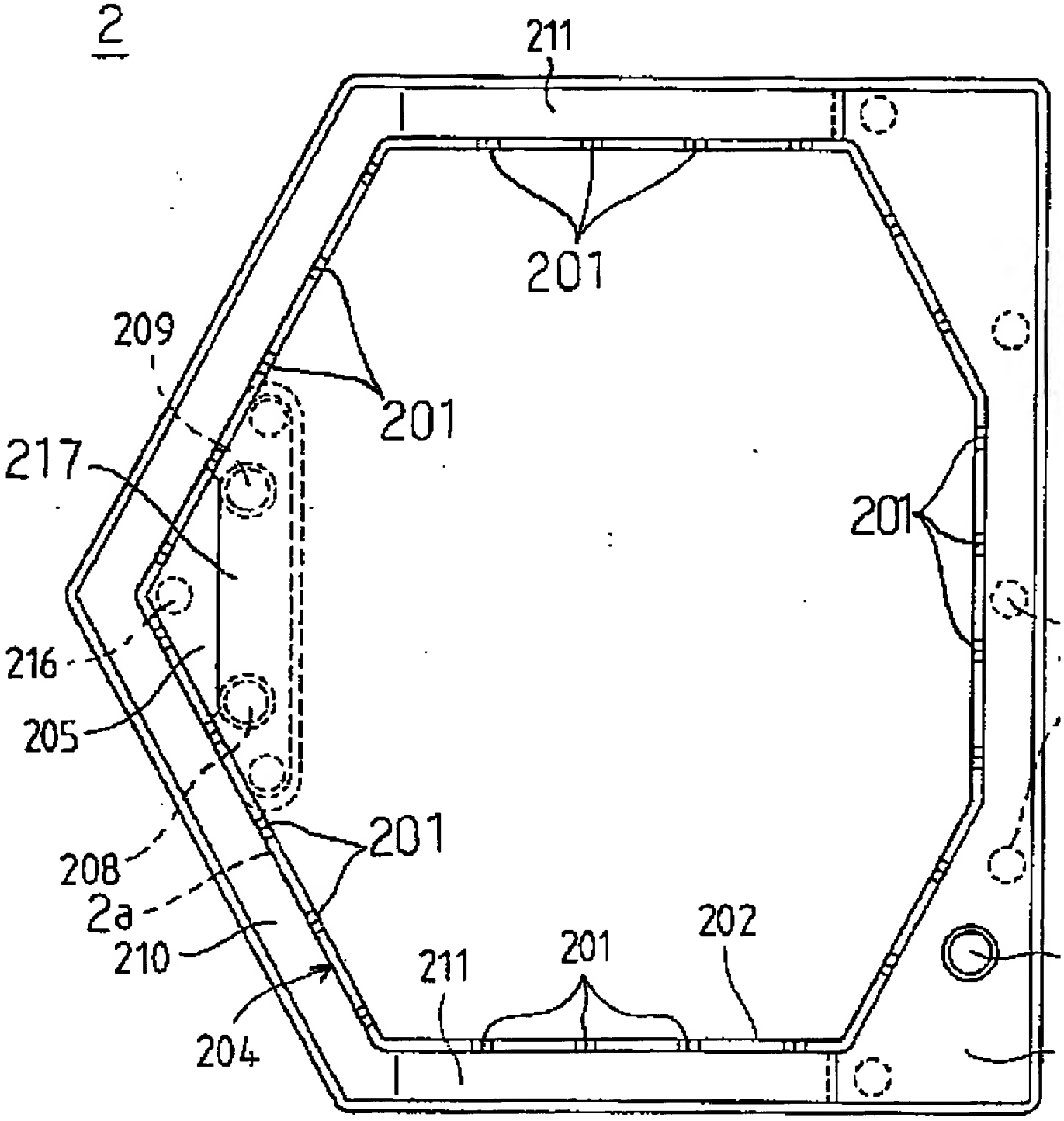
811
e

[Drawing 10]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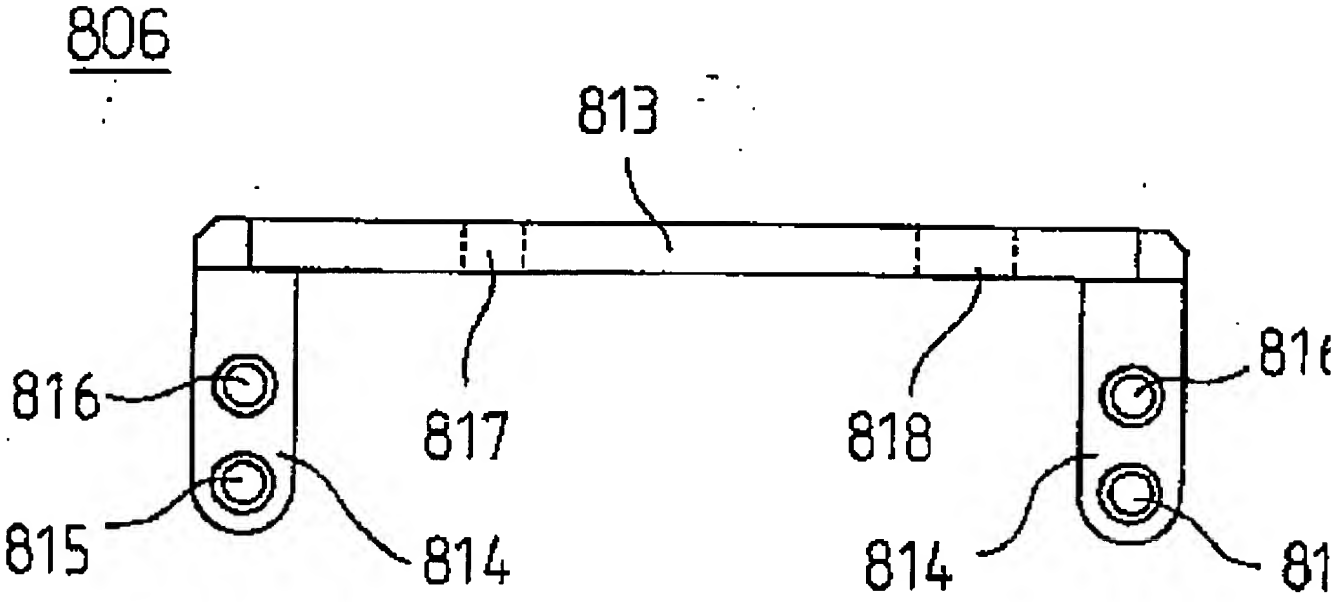
[Drawing 12]

(a)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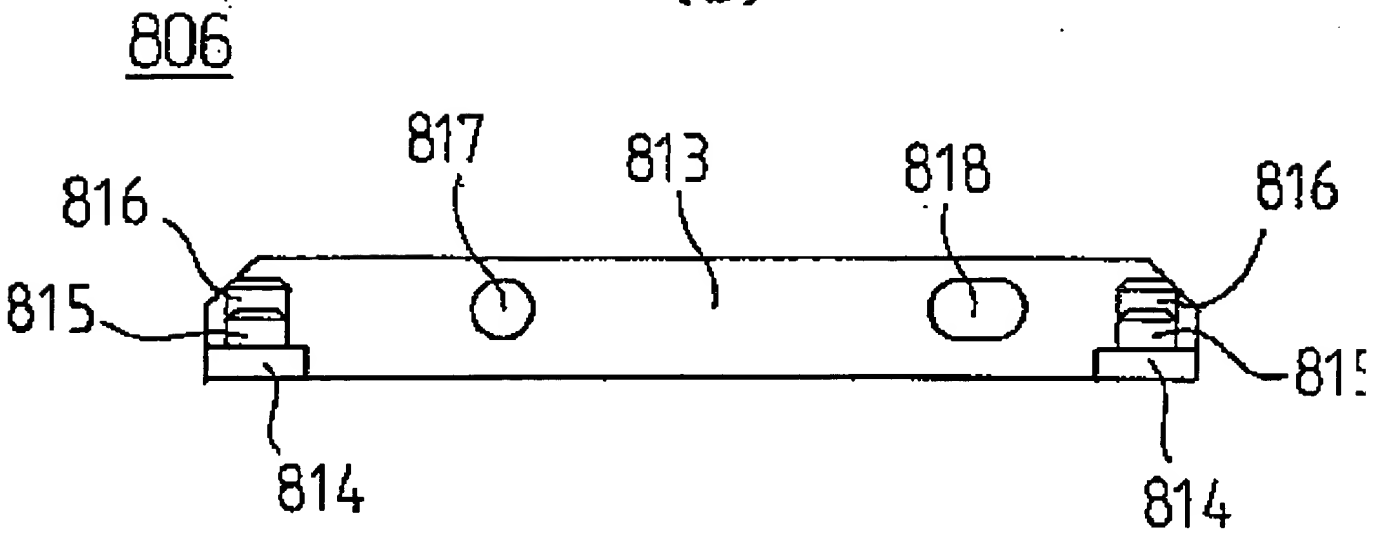
(b)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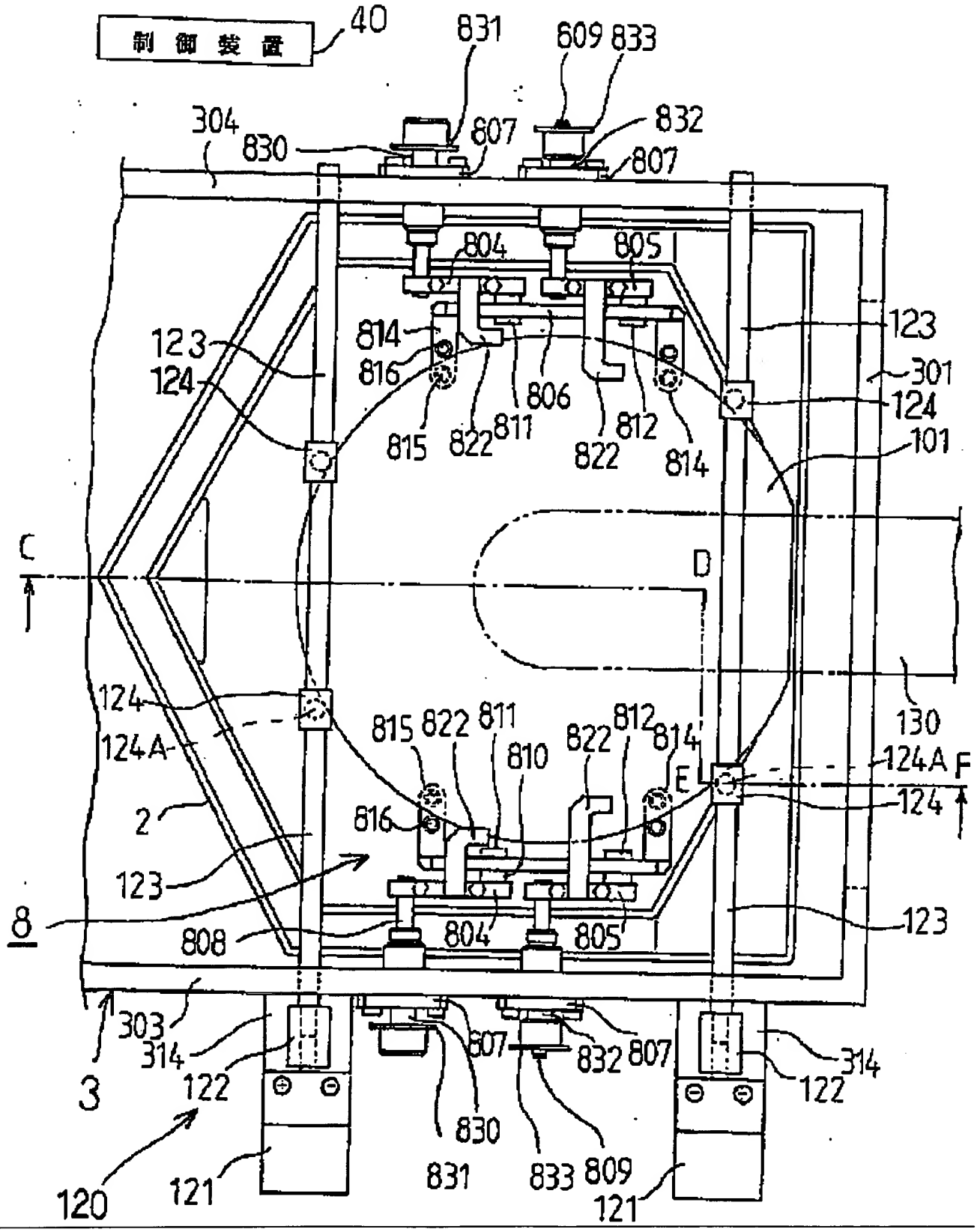
[Drawing 15]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822
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812
814
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124A
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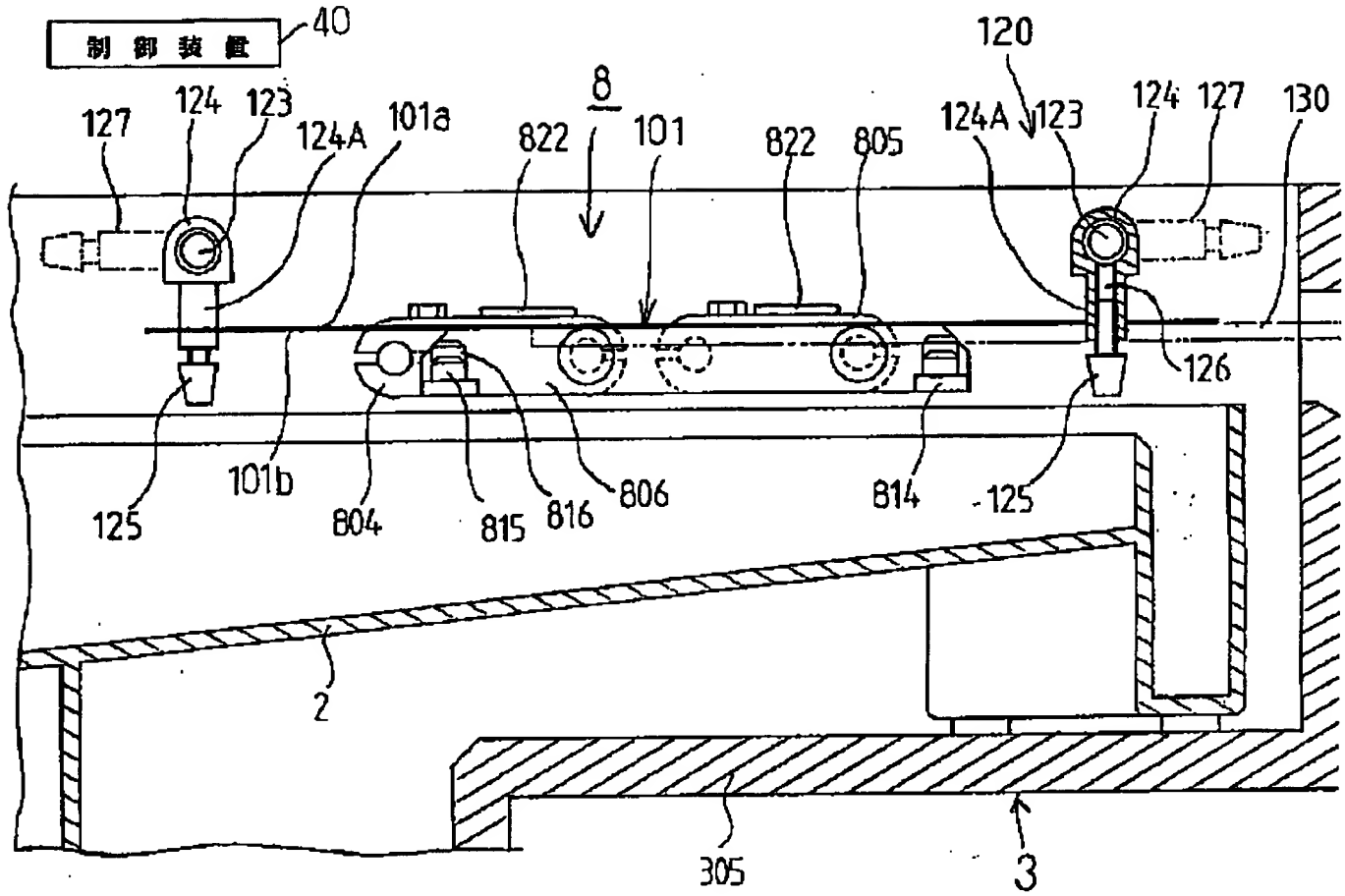
[Drawing 16]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806
814
125
2
305
3

[Translation done.]